01.04-10/1/2000-02021

Final
Expanded Preliminary Assessment/ Site Investigation
U.S. Naval Ammunition Storage Detachment
Vieques Island, Puerto Rico
VOLUME I - REPORT

Prepared for

Department of the Navy
Atlantic Division
Naval Facilities Engineering Command

Under the
LANTDIV CLEAN II Program
Contract No. N62470-95-D-6007
CTO-031

Prepared by

CH2MHILL

Tampa, Florida

October2000

Expanded Preliminary Assessment/ Site Investigation

Naval Ammunition Support Detachment

Vieques Island, Puerto Rico

Contract Task Order 031

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October 2000

Contents

List of Appendixes

List of Figures

List of Tables

List of Acronyms

AFWTF	Atlantic Fleet Weapons Training Facility
AOCs	Areas of Concern
ATG	Air-to-Ground Ordnance
bls	Below land surface
BTAG	Biological Technical Assistance Group
COCs	Contaminants of concern
COPC	Chemicals of potential concern
EM	Enlisted Men
EMA	Eastern Maneuver Area
EOD	Explosive Ordnance Demolition
GPS	Global Positioning Satellite
HQ	Hazard quotient
IAS	Initial Assessment Study
ICR	Incremental lifetime cancer risk
IR	Installation Restoration
IRFNA	Inhibited red fuming nitric acid
IRIS	Integrated Risk Information System
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
MS/MSD	Matrix Spike/Matrix Spike Duplicate
msl	Mean sea level
NASD	Naval Ammunition Support Detachment

NFRAP	No further response action planned
NGFS	Naval Gunfire Support
NPL	National Priority List
NSRR	Naval Station Roosevelt Roads
OVM	Organic vapor meter
PA/SI	Preliminary Assessment/Site Investigation
PCBs	Polychlorinated biphenyls
PCOC	Potential contaminant of concern
ppm	Parts per million
PRASA	Puerto Rico Aqueduct and Sewer Authority
PVC	Polyvinyl Chloride
QA/QC	Quality assurance/quality control
RAGS	Risk Assessment Guidance
RI	Remedial investigation
SVOCs	Semi-volatile organic compounds
SWMUs	Solid Waste Management Units
TPH	Total petroleum hydrocarbon
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
UST	Underground storage tank
UXO	Unexploded ordnance
VOCs	Volatile Organic Compounds
μg/L	Micrograms per liter

Executive Summary

This report documents the findings of the Expanded Preliminary Assessment/Site Investigation (PA/SI) activities completed for ten sites located at the Naval Ammunition Support Detachment (NASD), Vieques, Puerto Rico. The ten sites include seven Solid Waste Management Units (SWMUs) and three Areas of Concern (AOCs) as listed below.

- SWMU 04 - Inactive Waste Explosive Open Burn/Detonation Area
- SWMU 05 – IRFNA/MAF-4 Disposal Site
- SWMU 06 - Mangrove Disposal Site
- SWMU 07- Quebrada Disposal Site
- SWMU 10 - Waste Paint and Solvents Disposal Site
- SWMU 14 - Wash Rack
- SWMU 15 - Waste Transportation Vehicle Area
- AOC C - Drainage Ditch in the Vicinity of the Transportation Shop
- AOC-E - UST Site 2016
- AOC-F - Septic Tank Site

These 10 sites were originally identified as potential release locations and addressed separately under various investigations including Confirmation Sampling, Resource Conservation and Recovery Act (RCRA) Facility Assessments (RFAs), PA/SIs, and Underground Injection Control (UIC) investigations for storage tanks and septic tanks from 1988 through 1999.

The Expanded PA/SI was conducted by CH2M HILL for the Atlantic Division, Naval Facilities Engineering Command, under the Navy's Installation Restoration (IR) Program. While these 10 sites are not on the National Priority List (NPL), the investigations of these sites are being conducted in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process. The scope of the field program was designed to meet the following objectives:

- Determine the environmental suitability of the property for transfer to the Municipality of Vieques, as mandated by President Clinton's directive on January 31, 2000.
- Determine whether a release of hazardous materials has occurred at each of the 10 sites by sampling appropriate environmental media (soil, groundwater, surface water, sediment).
- Compare validated laboratory data from environmental samples to background levels and U.S. Environmental Protection Agency (USEPA) Region III risk-based criteria.
- Recommend sites for either no further response action planned (NFRAP) or further investigation.

The scope of the investigation included field sampling and analysis of surface soil, subsurface soil, groundwater, surface water, and sediment. Additionally, surface geophysical surveys and unexploded ordnance (UXO) avoidance surveys were conducted at SWMU 04 and SWMU 06.

The laboratory results were compared to background soil and groundwater data from Camp Garcia and to EPA Region III Risk Based Criteria (RBCs) and to EPA Region III Soil Screening Levels (SSLs). The results of the screening analysis are summarized in Table E-1. The results of the screening analysis and recommendations are presented for each of the 10 sites below.

SWMU 04

The Expanded PA/SI field investigation for SWMU 04 was conducted from April through June 2000, and included geophysical surveys, unexploded ordnance (UXO) clearance, installation and sampling of eight monitoring wells, and collection of surface soil and subsurface soil samples from 12 borings. All samples were analyzed for metals, VOCs, SVOCs, pesticides, PCBs, and explosives.

Parameters exceeding screening criteria in surface soils included aluminum, arsenic, iron, lead, thallium, vanadium, 2,4-dinitrotoluene, 2,4,6-trinitrotoluene, and hexahydro-1,3,5-trinitro-1,3,5,7-tetrazocine. In subsurface soils, the metals arsenic and barium exceeded screening criteria. Parameters exceeding screening criteria in groundwater included

aluminum, barium, cadmium, chromium, iron, manganese, nickel, selenium, vanadium, and zinc. In addition, various small UXO and spent munitions were discovered at the site.

SWMU 04 is recommended for a full Remedial Investigation/Feasibility Study (RI/FS) for soil exceedances. An additional background study is also recommended for soil and groundwater. A separate investigation is recommended to delineate the extent of UXO in the main 40-50 acre disposal area. Institutional controls, including a fence, signs, buoy markers in the water, and roving security around the perimeter to keep the public out of the area are also recommended.

SWMU 05

The Expanded PA/SI field investigations for SWMU 05 was conducted in April and May 2000, and included collection of surface soil and subsurface soil samples from four borings. The samples were analyzed for VOCs, SVOCs, and explosives.

The only parameter exceeding screening criteria was benzo(a)pyrene in one surface soil sample. The data indicate that the lone constituent detected in surface soil was the result of asphalt runoff rather than a release of hazardous material or disposal of fuel.

No further sampling is recommended for SWMU 05. However, it is recommended that a Preliminary Risk Evaluation (PRE) be conducted to calculate the potential risk to human health presented by benzo(a)pyrene in surface soil at the site.

SWMU 06

The Expanded PA/SI field investigation for SWMU 06 was conducted in April and May 2000 and included geophysical surveys; UXO clearance; installation and sampling of four monitoring wells; and collection of seven surface water/sediment samples, eight surface soil samples, and four subsurface (above the water table) samples. The samples were analyzed for metals, VOCs, SVOCs, pesticides, explosives, and PCBs.

Parameters exceeding screening criteria in surface soils included aluminum, antimony, arsenic, iron, lead, thallium, and benzo(a)pyrene. In subsurface soils, only arsenic exceeded screening criteria. Parameters exceeding screening criteria in groundwater included aluminum, arsenic, barium, cadmium, iron, lead, manganese, PCB-1221, and PCB-1232. In surface water, arsenic, copper, lead, mercury, and silver exceeded screening criteria. Parameters exceeding screening criteria in sediment included arsenic, chromium, copper, lead, nickel, and zinc.

A full RI/FS and risk assessment is recommended for SWMU 06 to determine the extent of contamination in soil, groundwater, surface water, and sediment. An additional background study is also recommended for soil and groundwater. Institutional controls, including posts, chains, and signs are recommended to demarcate the area during the RI/FS process.

SWMU 07

The Expanded PA/SI field investigation for SWMU 07 was conducted in April 2000 and included re-sampling of one existing monitoring well, installation and sampling of two new monitoring wells, and resampling of six surface soil locations and three sediment locations. The samples were analyzed for metals, VOCs, SVOCs, pesticides, and PCBs.

Parameters exceeding screening criteria in surface soils included aluminum, arsenic, chromium, copper, iron, lead, manganese, thallium, vanadium, benzo(a)pyrene, and acetone. Parameters exceeding screening criteria in groundwater included aluminum, antimony, arsenic, iron, manganese, vanadium, and zinc. Parameters exceeding screening criteria in sediment include chromium, copper, and nickel.

A full RI/FS and risk assessment is recommended for SWMU 07 to determine the extent of contamination in surface soil. An additional background study is also recommended for soil and groundwater. Institutional controls, including posts, chains, and signs are recommended to demarcate the area during the RI/FS process.

SWMU 10

The Expanded PA/SI field investigations at SWMU 10 were conducted in April and May 2000, and included the collection of 10 surface soil samples and 10 subsurface soil samples. The samples were analyzed for metals, VOCs, SVOCs, pesticides and PCBs.

Parameters exceeding screening criteria in surface soils included aluminum, arsenic, iron, lead, and thallium. No constituents exceeded screening criteria in subsurface soil.

No further sampling is recommended for SWMU 10. A soil background investigation is recommended, however, to characterize the range of metal concentrations in soils at the public works area. Additionally, it is recommended that a PRE be conducted to calculate the potential risk to human health presented by metals in surface soil at the site. Institutional controls, including signs are recommended to demarcate the site through the entire CERCLA process.

SWMU 14

The Expanded PA/SI field investigation at SWMU 14 was conducted in April and May 2000, and included the installation and sampling of two monitoring wells, collection of 14 surface and subsurface soil samples, and collection of three samples of the accumulated soil from the oil/water separator. All samples were analyzed for metals, VOCs, SVOCs, pesticides, and PCBs.

Parameters exceeding screening criteria in surface soils included aluminum, arsenic, iron, lead, thallium, and vanadium. In subsurface soils, only arsenic exceeded screening criteria. Parameters exceeding screening criteria in groundwater included aluminum, antimony, iron, manganese, vanadium, and dieldrin.

No further sampling is recommended for SWMU 14. A soil background investigation is recommended, however, to characterize the range of metal concentrations in soils at the public works area. Additionally, it is recommended that a PRE be conducted to calculate the potential risk to human health presented by metals in surface soil at the site. Institutional controls recommended for SWMU 14 include a chain-link fence and signs to demarcate the site. The fence and signs should remain until the CERCLA process is completed for the site. Also, it is recommended that the wash rack and oil/water separator be closed and removed from the site.

SWMU 15

The Expanded PA/SI field investigation at SWMU 15 included the installation and sampling of one monitoring well and the collection of 16 surface soil samples. The samples were analyzed for metals, VOCs, SVOCs, pesticides, and PCBs.

Parameters exceeding screening criteria in surface soils included aluminum, arsenic, iron, lead, thallium, and vanadium. Parameters exceeding groundwater screening criteria included aluminum, antimony, iron, manganese, and vanadium.

No further sampling is recommended for SWMU 15. However, a soil background investigation is recommended to characterize the range of metal concentrations in soils at the public works area. Additionally, it is recommended that a PRE be conducted to calculate the potential risk to human health presented by metals in surface soil at the site. Institutional controls recommended for SWMU 15 include a chain-link fence and signs to demarcate the site. The fence and signs should remain until the CERCLA process is completed for the site.

AOC C

The Expanded PA/SI field investigation at AOC C included the installation and sampling of one monitoring well, collection of fifteen surface soil samples, collection of 20 subsurface soil samples, and the collection of two sediment samples. The samples were analyzed for metals, VOCs, SVOCs, pesticides and PCBs.

Parameters exceeding screening criteria in surface soils included aluminum, arsenic, iron, manganese, thallium, and vanadium. In subsurface soils, only arsenic and manganese exceeded screening criteria. Parameters exceeding groundwater screening criteria included aluminum, iron, manganese, and vanadium.

No further sampling is recommended for AOC C. A soil background investigation is recommended, however, to characterize the range of metal concentrations in soils at the public works area. Additionally, it is recommended that a PRE be conducted to calculate the potential risk to human health presented by metals in surface soil at the site. Institutional controls recommended for AOC C include signs to demarcate the site. The signs should remain until the CERCLA process is completed for the site.

AOC E

The Expanded PA/SI field investigation at AOC E included the installation and sampling of three new monitoring well and the collection of groundwater samples from two existing monitoring wells. The samples were analyzed for metals, VOCs, SVOCs, pesticides and PCBs.

Parameters exceeding groundwater screening criteria included aluminum, antimony, arsenic, barium, chromium, copper, iron, manganese, nickel, vanadium, dieldrin, benzene, 1,2-dichloroethane, naphthalene, and 2-methylnaphthalene. In addition, free product was measured in monitoring well AOC E-MW 01, located in the vicinity of the UST.

Evidence exists to suggest that a release of petroleum hydrocarbons to groundwater has occurred at this site as a result of site-related activities. Additional investigations are recommended through the Full RI/FS process to delineate the extent of the petroleum hydrocarbons within the groundwater at the site. In addition, it is recommended that the free product be remediated.

Institutional controls recommended for AOC E include a chain-link fence and signs to demarcate the site. The fence and signs should remain until the CERCLA process is completed for the site.

AOC F

The Expanded PA/SI field investigation at AOC F included the installation and sampling of five monitoring well and the collection of twenty subsurface soil samples. The samples were analyzed for metals, VOCs, SVOCs, pesticides and PCBs.

Parameters exceeding screening criteria in subsurface soils included arsenic, chromium, and manganese. Parameters exceeding groundwater screening criteria included aluminum, antimony, iron, manganese, and vanadium.

No further sampling is recommended for AOC F. A soil background investigation is recommended, however, to characterize the range of metal concentrations in soils at the public works area. Additionally, it is recommended that a PRE be conducted to calculate the potential risk to human health presented by metals in surface soil at the site. Institutional controls recommended for AOC F include signs to demarcate the site. The signs should remain until the CERCLA process is completed for the site.

Summary

In summary, the following sites are recommended for further action including a full RI/FS:

- SWMU 04 - Inactive Waste Explosive Open Burn/Detonation Area
- SWMU 06 - Mangrove Disposal Site
- SWMU 07- Quebrada Disposal Site
- AOC-E - UST Site 2016

No further sampling is recommended for SWMU 05; however, a PRE is recommended to quantify the potential risk of the benzo(a)pyrene detected in one surface soil sample.

For the remaining sites, SWMU 10, SWMU 14, SWMU 15, AOC C, and AOC F, a more detailed background soil investigation is recommended that will include sampling from undisturbed areas that are representative of each site. Also, a PRE is recommended for these sites to evaluate the risk to human health and the environment.

Table E-1

CONSTITUENT CONCENTRATIONS EXCEEDING SCREENING CRITERIA

Media Sampled	SWMU-4(a)	SWMU-5(c)	SWMU-6(a)	SWMU-7(a)	SWMU-10(c)	SWMU-14(c)	SWMU-15(c)	AOC-C(c)	AOC-E(a)	AOC-F(c)
Surface Soil Metals	Al, As, Fe, Pb, Tl, V (b)	NS	Al, Sb, As, Fe, Pb, Tl	Al, As, Cr, Cu, Fe, Pb, Mn, Tl, V (b)	Al, As, Fe, Pb, Tl (b)	Al, As, Fe, Pb, Tl, V (b)	Al, As, Fe, Pb, Tl, V, Cr (b)	Al, As, Fe, Tl, V, Mn (b)	NS	NS
Surface Soil Organics	2,4-dinitrotoluene, 2,4,6-trinitrotoluene, hexahydro-1,3,5-trinitro-1,3,5,7-tetrazocine	benzo(a)pyrene	benzo(a)pyrene	benzo(a)pyrene, acetone	NONE	NONE	NONE	NONE	NS	NS
Subsurface Soil Metals	As, Ba (b)	NS	As (b)	NS	As	As, (b)	NS	As, Mn (b)	NS	As, Cr, Mn (b)
Subsurface Soil Organics	NONE	NONE	NONE	NS	NONE	NONE	NS	NONE	NS	NONE
Groundwater Dissolved Metals	Ba, Cd, Mn (b)	NS	Ba, Cd, Mn (b)	Al, Fe, Mn, V	NS	Sb, Mn	Mn	NONE	Al, Fe, Mn	Mn (b)
Groundwater Total Metals	Al, Ba, Cd, Fe, Mn (b)	NS	Al, As, Ba, Cd, Fe, Pb, Mn (b)	Al, Sb, As, Fe, Mn, V, Zn (b)	NS	Al, Sb, Fe, Mn, V (b)	Al, Sb, Fe, Mn, V (b)	Al, Fe, Mn, V (b)	Al, Sb, As, Ba, Cr, Cu, Fe, Mn, Ni, V (b)	Al, Sb, Fe, Mn, V (b)
Groundwater Organics	NONE	NS	PCB-1221, PCB-1232	NONE	NS	dieldrin	NONE	NONE	dieldrin, 2-methylnaphthalene, naphtalene, benzene, 1,2-dichloroethane	NONE
Surface Water	NS	NS	As, Cu, Pb, Hg, Ag	NS	NS	NS	NS	NS	NS	NS
Sediment	NS		As, Cr, Cu, Pb, Ni, Zn	Cr, Cu, Ni	NS	NS	NS	NS	NS	NS

NS = Not Sampled
NONE=Not Detected or Below Screening Criteria

Notes:
(a) Full Remedial Investigation/Feasibility Study (RI/FS) Recommended
(b) Additional Background soil investigation will be conducted during Phase II Study
(c) No Further Sampling Recommended

SECTION 1

Introduction

1.1 Background

On January 31, 2000, President Clinton issued a directive to the Secretary of Defense stipulating that the Navy shall submit legislation to Congress to transfer the Naval Ammunition Support Detachment (NASD) on Vieques Island, Puerto Rico, with the exception of approximately 100 acres of land on which the Relocatable Over The Horizon Radar and Mount Pirata telecommunications sites are located, to the Government of Puerto Rico no later than December 31, 2000.

Through an Initial Assessment Study (IAS) in 1984 and a RCRA Facility Assessment (RFA) in 1988, the Navy has identified 10 potentially contaminated properties to be transferred to the Government of Puerto Rico. The ten sites include seven Solid Waste Management Units (SWMUs) and three Areas of Concern (AOCs) as listed below.

- SWMU 04 - Inactive Waste Explosive Open Burn/Detonation Area
- SWMU 05 – IRFNA/MAF-4 Disposal Site
- SWMU 06 - Mangrove Disposal Site
- SWMU 07- Quebrada Disposal Site
- SWMU 10 - Waste Paint and Solvents Disposal Site
- SWMU 14 - Wash Rack
- SWMU 15 - Waste Transportation Vehicle Area
- AOC C - Drainage Ditch in the Vicinity of the Transportation Shop
- AOC-E - UST Site 2016
- AOC-F - Septic Tank Site

As part of the EBS and CERCLA process, the Navy has taken a very conservative approach to the identification and delineation of potentially contaminated areas. As such, areas where potential release of a hazardous substance exists have been considered to be potentially contaminated and are undergoing further investigation under the Navy's Installation Restoration (IR) Program.

This document presents the results of the Expanded Preliminary Assessment/Site Investigation (PA/SI) completed in June 2000 for the ten sites. CH2M HILL completed the work under contract number N62470-95-D-6007, Navy CLEAN II Program, for the Atlantic Division of the Naval Facilities Engineering Command.

This expanded PA/SI was conducted to investigate sites that may need further work before the property can be transferred to the Puerto Rican government on December 31, 2000, as mandated by the President's directive.

1.2 Objectives of the Investigations

The scope of the field program was designed to meet the following objectives:

- Determine whether a release of hazardous materials has occurred at each of the 10 sites by sampling appropriate environmental media (soil, groundwater, surface water, sediment).
- Compare validated laboratory data from environmental samples to background levels and U.S. Environmental Protection Agency (USEPA) Region III risk-based criteria.
- Recommend sites for either no further response action planned (NFRAP) or further investigation.

1.3 Organization of the Report

This PA/SI Report is organized as follows:

Section 1, Introduction, provides background information regarding the PA/SI, summarizes the purpose of the investigation, describes the location and environmental history of the facility, discusses previous investigations, and provides information concerning the physical setting of the facility.

Section 2, Field Investigation Procedures, summarizes the field investigation activities, data quality, and screening procures used.

Sections 3 through 12 summarize by SWMU the investigations performed at the seven SWMUs and three AOCs at NASD during April, May, and June 2000. Each section includes the objectives of the Expanded PA/SI, a site description, results of previous investigations,

summary of field activities, summary of laboratory results, and conclusions and recommendations.

1.4 NASD Description

Vieques Island lies roughly 7 miles southeast of the U.S. Naval Station Roosevelt Roads (NSRR), Puerto Rico (Figure 1-1). The U.S. Navy occupies approximately 22,600 acres of the roughly 33,000 acres making up Vieques Island. The 22,600 acres consist of the following: NASD, which consists of 8,000 acres along the western third of the island; the Eastern Maneuver Area (EMA), which consists of 11,000 acres located in the east-central portion of the island; and the Atlantic Fleet Weapons Training Facility (AFWTF) which consists of 3,600 acres along the eastern portion of the island.

NASD has been utilized by the U.S. Navy Atlantic Fleet for storage of munitions. The activities at NASD were directed under the consolidated command of Commander Fleet Air Caribbean, Naval Forces Caribbean, and Antilles Defense Command, whose headquarters are at NSRR. The mission of NASD was to receive, store, and issue all ordnance authorized by NSRR for support of Atlantic Fleet activities.

Waste management activities at NASD included storage of aged or inoperable munitions. Within the public works section of NASD, the Navy generated small quantities of waste oils, degreasers, spent batteries, and tires during routine maintenance of vehicles conducted at the Transportation Shop (Buildings 2015 and 2016). A Waste Oil and Solvent Accumulation Area was located adjacent to the Transportation Shop. The public works area contained a Carpentry Shop for woodworking and painting, at which waste paints and solvents were generated. Most of the wastes were collected by a private contractor at the point of generation for offsite disposal. NASD also operated a sewage treatment plant and three septic tanks for domestic sewage. The sludge from the tanks is removed by a contractor for offsite disposal.

Six of the sites investigated as part of this effort are located within the public works area of NASD. The remaining four are located in remote areas of NASD. Detailed descriptions of each site are presented in section 3 through 12. The locations of the 10 sites are shown on Figure 1-2.

1.5 Previous Investigations

Environmental Science and Engineering (ESE) previously conducted a PA/SI for NASD SWMUs 5, 6, and 7 in 1988.

In September 1984, Greenleaf/Telesca Planners, Engineers, and Architects, Inc., prepared the *Initial Assessment Study, Naval Station Roosevelt Roads, Puerto Rico.*

In May 1986, ESE conducted the Confirmation Study to Determine Possible Dispersion and Migration of Specific Chemicals – U.S. Naval Station, Roosevelt Roads, Puerto Rico, and U.S. Naval Ammunition Facility (NASD), Vieques: Evaluation of Data from First Round of Verification Sample Collection and Analysis.

In October 1988, A.T. Kearney, Inc., and K.W. Brown & Associates, Inc., prepared the Phase II RCRA Facility Assessment of the Naval Ammunition Facility (NASD), Vieques Island, Puerto Rico.

In October 1992, Baker Environmental, Inc., prepared the Final Preliminary Assessment Narrative Report, Site Inspection Forms and PA Score, Sites 1, 2, and 3 (NASD), U.S. Naval Station, Roosevelt Roads, Puerto Rico.

In November 1999, Baker Environmental, Inc., prepared the Positive Detection Summary in Groundwater, Vieques Sites (NASD), Puerto Rico.

In November 1999, Baker prepared Results of the Hydrogeologic Investigation, Vieques Island, Puerto Rico.

A detailed description of the field investigations is presented in the Site-Specific Work Plan for NASD (CH2M HILL, April 2000). USEPA and Puerto Rico Environmental Quality Board (PREQB) commented on the Site-Specific Work Plan and the Master Work Plan for NASD (CH2M HILL, May 2000). The U.S. Navy's responses to these comments on the Site-Specific Work Plan and the Master Work Plan are included in Appendix A.

1.6 Physical Characteristics of the Study Area

This section summarizes the environmental setting of Vieques Island including location, land use, climate, topography and surface water, and geology, and groundwater.

1.6.1 Location

Vieques is the largest offshore island of Puerto Rico, with a surface area of approximately 51 square miles. It is located approximately 7 miles east-southeast of the eastern end of the main island of Puerto Rico. The Site occupies the western end of the island of Vieques, encompassing approximately 7,878 acres. The majority of the site is undeveloped and heavily vegetated with trees, low lying brush, and tall grasses. The southwestern portion of the site is the least developed, with the exception of the communications facilities on top of Mount Pirata (within the NASD but not technically, a part of the site). The central eastern portion of the Site was utilized for munitions magazines, which are scattered throughout the area. The northeastern portion of the site was the most developed, containing facilities for the main support compound. The southeastern portion of the Site contains the recently completed ROTHR station and associated facilities.

The site is traversed in different directions by paved asphalt and dirt roads, and is accessed from two guarded security gates. The main gate to the site is located at the extreme northeast end of the site near the Vieques Municipal Airport. The second gate is located at the southeast end of the site, providing access to the La Hueca area only.

The approximate coordinates of the center of the site are 18 degrees 7 minutes north latitude and 65 degrees 33 minutes west longitude.

1.6.1.1 Structures, Roads, and Other Site Improvements

The central and northeastern portions of the site were the most developed, and contained munitions storage magazines and installation support facilities. Paved roads are present along the north end and eastern boundary of the site, and in the main support compound and inactive munitions magazines. The road to the Mount Pirata communications facility is also paved. The remainder of the site is traversed by dirt or severely overgrown dirt and paved roads.

1.6.1.2 Vicinity Characteristics

The site is bounded by water on three sides: on the north by Vieques Sound, on the west by the Vieques Passage, and on the south by the Caribbean Sea. The site is bounded on the east by land controlled by the Puerto Rico Department of Natural Resources and the Puerto Rico Port Authority, and by private landowners. The Vieques Municipal Airport property lies

adjacent to the northeast portion of the site, with the portion abutting the site constituting the runway approach clear zone. South of the airport property is undeveloped land controlled by the Puerto Rico Department of Natural Resources, primarily used for cattle grazing. Further south lies the area known as the "South La Hueca" parcel. This area is inhabited by individual landowners with private homes and small pastures and farms.

1.6.2 Land Use

Although NASD occupies approximately 8,000 acres, most of the area is undeveloped and leased to local landowners for cattle grazing. NASD operates a 625-foot ammunition handling pier known as Mosquito Pier. Power on NASD is received from Puerto Rico via underwater transmission lines; therefore, no power production units other than emergency generators are located at NASD. Significant facilities at NASD include the Transportation Shop (Buildings 2015 and 2016), Carpentry Shop, and Sewage Treatment Plant.

1.6.3 Climate

The climate of Vieques is tropical-marine. Temperatures are nearly constant, with an annual average of about 79°F. August is the warmest month (82°F) and February the coolest (76°F). Vieques lies directly in the path of the prevailing easterly trade winds that regulate the climate of Puerto Rico. The trade winds result in a rainfall pattern characterized by a dry season from December through July and a rainy season from August to November. Heavy precipitation may be induced by tropical storms from June to November. The western part of the island, where the site is located, averages approximately 50 inches of rainfall per year, 50 percent of which occurs during the rainy season (USGS, 1989).

1.6.4 Topography and Surface Water

The topography of the site is characterized by a series of low hills and small valleys. The most elevated areas occur along a west to east axis near the center of the site. The highest point is Mount Pirata, approximately 987 feet above sea level. In general, the slope of the site tapers gradually down from the center to the coastal areas, with the exception of steep slopes in the vicinity of Mount Pirata.

Surface water present on the site consists of several lagoons and intermittent streams. The Arenas, El Pobre, and Kiani Lagoons are located at the northwestern end of the site, and the Playa Grande Lagoon is located at the southeast end of the site. These lagoons are generally

very shallow, and characterized by a large concentration of mangroves. All streams on the Site are ephemeral, flowing only for a short period of time after precipitation events. These natural storm drainage channels, called quebradas, are located throughout the site, generally running in a northerly or southerly direction downward from the central, elevated portions of the site. No lakes, rivers, or flowing springs are present on the site (USGS, 1989).

1.6.5 Geology

The geology of Vieques is characterized by volcanic rocks generally overlain by alluvial deposits and patches of limestone. Volcanic andesites of Late Cretaceous age were deposited in a marine environment. Later in the Cretaceous age, a quartz-diorite plutonic complex intruded the andesites, and is exposed over a large percentage of the island. A gradual change in texture from coarse to fine-grained quartz-diorite has been observed from west to east. Limestone of Tertiary age occurs in sectors of the north, south, and eastern parts of the island. The most extensive areas of limestone are found on the south coast peninsulas. The limestone is generally soft and yellowish and well indurated where exposed to the atmosphere. The sedimentary deposits are generally of Quaternary age, consisting of a mixture of sand, silt, and clay. The floodplains consist of beach and dune deposits formed by calcite, quartz, volcanic rock fragments and minor magnetite (USGS, 1989).

1.6.6 Groundwater

One groundwater aquifer is present on the site. The Resolucion Valley aquifer covers approximately the northern half of the site. The valley slopes from Mount Pirata toward the Vieques Passage, with an area of approximately eight square miles. Although there are no perennial streams in the valley, this area receives more rainfall than any other area of Vieques. The geology of the Resolucion Valley aquifer consists of sedimentary deposits which overlie a saprolite derived from plutonic rocks. Geophysical surveys show that alluvial deposits average about 30 feet thick (USGS, 1989).

Groundwater has not been used as a primary source of drinking water on Vieques since 1978 when an undersea pipeline from the island of Puerto Rico was installed. Emergency public supply wells have been used if the pipeline is out of service. The most recent usage of public back-up wells on Vieques for obtaining municipal water supplies is reported to have occurred in 1998 after Hurricane Georges.

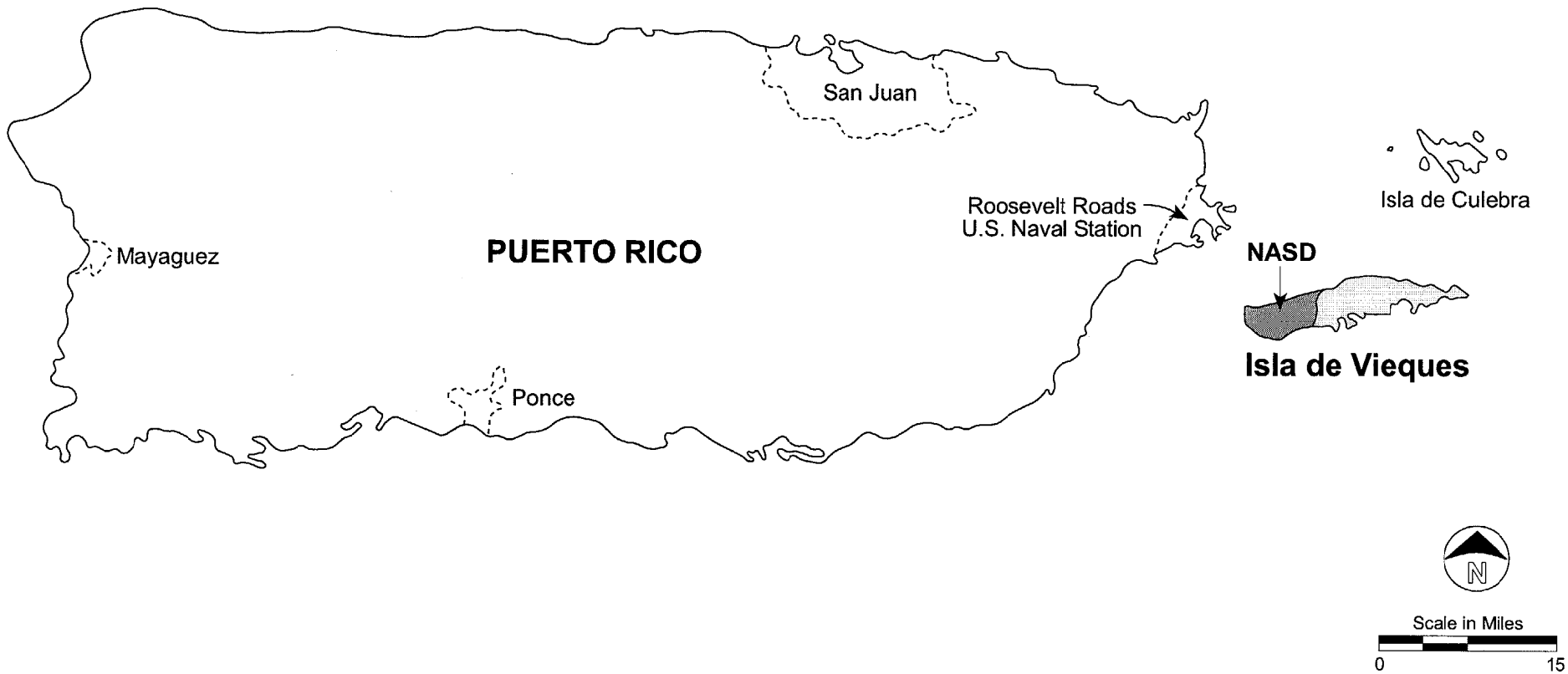

FIGURE 1-1
Site Location Map

Figure 1-2
SITE LOCATION MAP
Naval Ammunition Support Detachment, Vieques Island

CH2MHILL

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SECTION 2

Field Investigation Procedures

The PA/SI field investigations at NASD included monitoring well installation and sampling, soil sampling, surface water sampling, sediment sampling, groundwater elevation monitoring and surveying, qualitative ecological surveys, and geophysical surveying. The initial field investigation for the 10 sites was conducted from April 3, 2000, to May 2, 2000. A second mobilization for additional work at SWMU 04 and groundwater sampling at SWMU 04, SWMU 05, and SWMU 07 was conducted from May 31, 2000, through June 20, 2000.

Data generated from the investigation were intended to be of sufficient quantity and quality to meet regulatory standards and guidelines. To achieve this goal, the data were collected in accordance with the standard operating procedures presented in the Master Work Plan for the U.S. Naval Ammunition Storage Detachment, Vieques, Puerto Rico (CH2M HILL, May 2000) and with the Field Sampling Plan checklist presented in the Site Specific Work Plan for the U.S. Naval Ammunition Storage Detachment, Vieques, Puerto Rico (CH2M HILL, April 2000). USEPA and Puerto Rico Environmental Quality Board (PREQB) commented on the Site Specific Work Plan and the Master Work Plan. The U.S. Navy's responses to these comments on the Site Specific Work Plan and Master Work Plan are included in Appendix A.

Brief descriptions of the field procedures used during the Expanded PA/SI are provided in the following subsections. Detailed descriptions of the field investigations can be found in the approved Site-Specific Work Plan for NASD (CH2M HILL, April 2000).

2.1 Decontamination of Sampling Equipment

Drill rigs and auger flights were decontaminated by washing with potable water using a high-pressure cleaner before use and between borings. Sampling equipment including pumps, sampling spoons, split-spoons, hand augers, and bowls) were decontaminated between each sample location using the following procedure:

- Rinse with potable water to remove most of the soil

- Wash with scrub brush using potable water and Alconox (non-phosphate soap)
- Rinse with potable water
- Rinse with isopropyl alcohol
- Rinse with laboratory grade deionized water
- Air dry

2.2 Monitoring Well Installation

Twenty-six monitoring wells were installed as a part of the field investigation. The monitoring wells were constructed of 2-inch-diameter, Schedule 40, polyvinyl chloride (PVC), well casing and well screen. The annular space between the well screen borehole was filled with a silica sand pack that extends above the well screen. A bentonite seal was installed above the sand pack, and the annular space above the bentonite seal was filled with a cement/bentonite grout. Each monitoring well was equipped with a protective surface casing, concrete pad and locking cap to prevent unauthorized access to the wells.

Twenty-two monitoring wells were installed at the first encountered groundwater within the bedrock using down-the-hole hammer drilling methods. During the drilling of the boreholes for these monitoring wells, drill cuttings were collected at approximately 5-foot intervals or at changes in drilling conditions and examined for lithology. All wells were logged in the field during drilling. The lithologic logs are included in Appendix B. Additionally, soil samples were screened in the field with an Organic Vapor Meter (OVM). OVM readings are included in Appendix B.

The four monitoring wells at SWMU 06 were installed using a hand auger because a drilling rig could not be used in the thick mangroves that cover this site. During the hand auger drilling, soil samples were collected at 2-foot intervals using the hand auger bucket. Soil boring logs for these wells are included in Appendix C.

Well construction details are summarized in Table 2-1. Well construction diagrams are provided in Appendix C.

Drill cuttings generated during monitoring well installation were collected and stored onsite in 55-gallon drums. The disposal method for these cuttings will be determined based on

results of the soil and groundwater analyses as specified in the Investigation-Derived Waste Management Plan (CH2M HILL, May 2000).

2.2 Monitoring Well Development

Monitoring well development was performed using a combination of pumping and swabbing with a stainless steel Grundfos® submersible pump or a Whaler submersible pump.

The submersible pump was placed at the bottom of the screen and the well was pumped until clear water (minimal turbidity) was produced. The pump was then moved up and down (swabbed) through the screened interval to force water in and out of the screen. The turbidity would increase when the pump was moved up to a new portion of the screen. Pumping and swabbing continued until clear, sediment-free water was generated.

Well development records are summarized in Table 2-2 and are provided in detail in Appendix D.

2.3 Monitoring Well Purging and Sampling

The wells were either purged and sampled with a stainless steel Grundfos® submersible pump, Fultz® pump, or a peristaltic pump, depending on the depth to water and the water recharge rate of the well.

Prior to sampling, a minimum of three well volumes of water were purged from each well. The wells were pumped at a rate of approximately 0.25 to 0.5 gallons per minute. Water quality data including temperature, conductivity, salinity, and pH were monitored during purging and the well was sampled after the parameters stabilized (less than 10 percent fluctuation). After purging, the wells were sampled using the submersible pump. New separate Tygon® tubing was used for each well. The pump and cables were decontaminated between wells by washing with potable water and Alconox and rinsing with potable water. Potable water was pumped through the submersible pump during rinsing. Monitoring well purging and sampling logs are included in Appendix E.

2.4 Groundwater Elevation Measurements

Groundwater elevation measurements were obtained from all monitoring wells on May 3 and August 18, 2000. An electronic water level meter was used to measure the depth to water from the top of casing of each monitoring well. Table 2-3 summarizes the results of these measurements.

2.5 Surface Soil Sampling

Surface soil samples were collected from zero to 6 inches below land surface (bls). The top layer of grass and soil (approximately 1 inch) was scraped away before sampling began. Surface soil samples were collected using a stainless steel spoon and/or hand auger. The soil was placed in a stainless steel bowl. Samples for volatile organic compound (VOC) analysis were collected first using an Encore™ sampling device, and then samples for semi-volatile organic compounds (SVOCs), metals, pesticides, polychlorinated biphenyls (PCBs), and explosives were transferred to appropriate laboratory glass jars.

2.6 Subsurface Soil Sampling

Subsurface soil samples were collected using a split-spoon sampler with an auger drilling rig. A hole was advanced to a depth of 4 feet bls using a 4.25-inch-diameter auger. All soil borings were logged in the field during drilling. Soil boring logs are included in Appendix B. To collect a sufficient amount of soil for all of the analyses, a 3-inch-diameter split-spoon was driven from 4 to 6 feet bls. The split-spoon was removed from the hole, opened, and the VOC sample was collected immediately using the Encore™ sampling device. After the VOC sample was collected, the soil was removed from the split-spoon and placed in a stainless steel bowl, and then samples for SVOCs, metals, pesticides, PCBs, and explosives were transferred to appropriate laboratory glass jars.

2.7 Surface Water and Sediment Sampling

Surface water samples were collected at SWMU 06 from a kayak in water approximately 3 feet deep. Field parameters (temperature, conductivity, salinity, dissolved oxygen (DO), pH, flow, flow direction, water depth, and total dissolved solids [TDS]) were measured prior to sample collection. Surface water samples were then collected by submerging the

sampling container directly into the surface water body. Surface water sampling logs are included in Appendix F.

Sediment samples were collected at the locations of the surface water samples at SWMU 06 after collection of the surface water sample to ensure that any sediment disturbed during the sediment sampling did not enter the surface water sampling container. The sediment samples were collected using a stainless-steel trowel.

Sediment samples were collected from SWMU 07 in the same manner as surface soil samples were collected because the ditch was dry at the time of sampling. Sediment samples were collected from the wash rack sump at SWMU 14 and from the catch basins in the ditch area of AOC C using a sample jar attached to a flexible pole.

2.8 Surveying

The monitoring well locations and sampling locations (surface soil, soil borings, surface water, and sediment) were surveyed in the field using Global Positioning Satellite (GPS) techniques. The survey established the latitude and longitude coordinates for each of the locations. In addition, the elevation in feet above mean sea level (msl) was established to the nearest 0.01 foot for the monitoring wells. The elevations of the wells were established using traditional surveying techniques for sites in the public works area and GPS techniques for remote sites. The survey data is provided on Table 2-4.

2.9 Geophysical Surveys

Surface geophysical surveys were performed at SWMU 04, SWMU 06 and the public works area by Subsurface Detection Investigations, Inc. (SDII). Magnetometer surveys were conducted at SWMU 04 and SWMU 06 to map potential areas of buried ferrous metal. An electromagnetic (EM-61) survey was conducted in the public works area (SWMU 10, SWMU 14, SWMU 15, AOC C, AOC E, and AOC F) to map buried utilities. Geophysical surveys were conducted in accordance with standard operating procedures presented in the Master Work Plan (CH2M HILL, May 2000). Transects were surveyed on the ground for the EM-61 survey in the public works area. For the magnetometer surveys, a GPS system was used to locate the survey points. Geophysical survey reports are included in Appendix G.

2.10 Unexploded Ordnance Surveys

Unexploded ordnance (UXO) avoidance surveys were conducted by Blackhawk Geometrics to clear sites for sampling, drilling and geophysical surveys. Before mobilizing to the field, Blackhawk prepared a UXO avoidance plan that describes the procedures to clear sites for environmental investigations. During the first mobilization (April-May 2000) for the field investigation, Blackhawk performed a visual surface sweep for ordnance and explosives ahead of the geophysical survey team on SWMU 04 and SWMU 06. Also during the first mobilization, Blackhawk cleared sampling sites at SWMU 04, SWMU 05, SWMU 06, and SWMU 07. During the second mobilization (June 2000) of the field work, UXO avoidance work was performed in SWMU 04. UXO reports are included in Appendix H.

2.11 Qualitative Ecological Survey

In order to evaluate potential effects on the biota present at each SWMU, an ecological survey was performed on NASD property on May 15 through 19, 2000. The purpose of this assessment was to determine the following:

- Identify habitat types and evaluate the presence of sensitive or unique habitats
- Determine the potential presence of endangered and threatened species and/or their habitats
- Assess any indicators of stress on vegetative communities or wildlife populations present
- Identify potential pathways for contaminant migration through bioaccumulation

Habitat types were characterized based on color signatures from true-color aerial photographs dated November 4, 1999 at a scale of 1 to 6000. Vegetation communities were delineated using magnified stereo pairs of aerial photography and verified in the field. Relative vegetative dominance and species structure were characterized by visual observations within each community type. Plant health was evaluated at each site by presence or absence of chlorotic leaves, epinasty (deformities of leaves and stems), patches of altered plant growth, absence of plants (bare ground), and changes in species composition. A nearby representative site was selected as a control for comparison purposes.

Wildlife species residing within or utilizing each SWMU habitat, and wildlife habitat were identified during the vegetation field surveys. Any wildlife species that were observed were identified in the field with the use of binoculars and reference guides (Raffaele 1989 and Raffaele et al 1998).

Fourteen federally listed species are known to occur or have the potential to occur on NASD Vieques (see Table 2-5 in Appendix B). Prior to conducting the fieldwork, a literature search was conducted for each federally protected species. During the May 15-19 surveys, biologists walked transects through each site to determine the potential presence of any federally protected species and noted the presence or absence of preferred habitat for the species.

In addition to wildlife surveys in the field, existing literature sources were used to identify any additional species that may have occurred on the SWMU sites but were not observed. Through these surveys, no federally protected species were identified at these sites. Most of the wildlife occurring in the area is bird species and these are presented in Appendix I. Species information and field data was used to generate a simplified food web for the sites. A food web is an interlocking pattern of several to many food chains that is helpful in determining ecosystem processes including those that may occur when a contaminant is introduced to a system.

The detailed qualitative ecological survey is included in Appendix I.

2.12 Risk-Based Criteria Screening Procedure

The screening of each site is based upon validated analytical results obtained from investigations conducted from April through June, 2000. These data provide the rationale for a recommendation of no further action (NFA) or further investigation for each site.

Concentrations of detected chemicals at each site were compared to the following current USEPA Region III screening criteria for each matrix: residential and industrial risk-based concentrations (RBCs) and soil screening level (SSL) criteria for soil; tap water RBCs and drinking water Maximum Contaminant Levels (MCLs) for groundwater; Ambient Water Quality Criteria (AWQC) for surface water; and Florida Sediment Quality Assessment Guidance (SQAG) for sediment. The RBCs and SSLs use the ingestion pathway. For the

ingestion, dermal, and inhalation pathways, toxicity criteria area used to define an acceptable level of contamination in soil, based on a one-in-a-million (10-6) individual excess cancer risk for carcinogens and a hazard quotient (HQ) of 0.1 for non-carcinogens.

In addition, preliminary background criteria were established using data obtained from the hydrogeologic investigation for Camp Garcia (CH2M HILL, November 4, 1999). This investigation at Camp Garcia was conducted to provide soil and groundwater data along the western perimeter of the Naval property.

In accordance with U.S. EPA guidance for conducting background studies (USEPA, 1995), background criteria were established as twice the arithmetic mean for contaminants detected during this investigation. Background Data are included in Appendix L.

An additional soils investigation will be completed at NASD to establish site-specific soil background conditions.

2.13 Laboratory Field Sampling Protocol

Prior to the collection of data, the intended data usage was evaluated and the proper level of data quality was established. Analytical data quality for the PA/SI is specified in terms of the following levels:

Level I – Used for field screening. The only Level I data collected as part of this PA/SI were OVM screening and water quality data collected during well purging and surface water sampling. Water quality data include pH, conductivity, temperature, and turbidity, DO, and oxidation reduction potential (ORP).

Level IV – Level IV data were considered definitive data and were required to undergo additional data validation processes external to the laboratory. Level IV data were obtained for all media samples to satisfy requirements for site characterization.

Surface soil, subsurface soil, surface water, sediment, and groundwater samples collected for analyses were placed on ice and shipped via overnight mail to Progress Environmental Laboratories located in Tampa, Florida. The samples were analyzed for VOCs, SVOCs, metals, pesticides, and PCBs. All samples from sites SWMU 04, SWMU 06, and SWMU 07 were analyzed for explosives using EPA Method 8330. Groundwater samples from sites SWMU 04, SWMU 06, and SWMU 07 were also analyzed for perchlorate. A summary of

laboratory data and chain-of-custody forms for the samples collected are provided in Appendix J.

Quality assurance/quality control (QA/QC) samples were also collected as discussed below:

- Duplicates - Field duplicate soil samples were collected at a frequency of 10 percent per sample matrix.
- Field Blank – A field blank was prepared by collecting a sample of analyte-free water in the area that soil sampling occurred.
- Equipment Blank - Equipment blanks were collected at a frequency of one per day.
- Matrix Spike/Matrix Spike Duplicate (MS/MSD) were collected at a frequency of 1 per 20 field samples per matrix and submitted for analysis.

2.14 Data Quality Evaluation

2.14.1 Purpose and Background

The purpose of the data quality evaluation process is to assess the effect of the overall analytical process on the usability of the data. The two major categories of data evaluation are laboratory performance and matrix interferences. Evaluation of laboratory performance is a check for compliance with the method requirements; either the laboratory did, or did not, analyze the samples within the limits of the analytical method. Evaluation of matrix interferences is more subtle and involves the analysis of several areas of results including surrogate spike recoveries, matrix spike recoveries, and duplicate sample results. Tables and attachments from this data quality evaluation are included in Appendix K.

Samples were collected from April 4, 2000 through June 12, 2000. Field QC samples collected included field duplicates, field blanks, trip blanks (analyzed for VOCs only), and equipment rinsate blanks. The number of each type of sample is listed by analytical method (Table 1 in Appendix K). The samples were analyzed for the following analytical fractions:

- Volatile organic compounds (VOCs) by CLP SOW OLMO4.2
- Semivolatile organic compounds (SVOCs) by CLP SOW OLMO4.2

- Metals by ILMO4.0
- Organochlorine Pesticides and PCB's by CLP SOW OLMO4.2
- Explosives by SW846 method 8330
- Low Level Organics by OLCO2.1

Before the analytical results were released by the laboratory, both the sample and QC data were carefully reviewed to verify sample identity, instrument calibration, detection limits, dilution factors, numerical computations, accuracy of transcriptions, and chemical interpretations. Additionally, the QC data were reduced and the resulting data were reviewed to ascertain whether they were within the laboratory-defined limits for accuracy and precision. Any non-conforming data were discussed in the data package cover letter and case narrative.

The hardcopy data packages were reviewed by the project data validation subcontractor (Heartland Environmental Services, Inc) using the process outlined in the EPA Region II's Functional Guidelines for Data Review (Organic and Inorganic) SOPs. Data validation checklists used were those specified by EPA Region II. Areas of review included (when applicable to the SOW) holding time compliance, calibration verification, blank results, matrix spike precision and accuracy, method accuracy as demonstrated by LCSs, field duplicate results, surrogate recoveries, internal standard performance, and interference checks. The Region II data review worksheet was completed for each of these data packages and any non-conformance documented. This data review and validation process is independent of the laboratory's checks and focuses on the usability of the data to support the project data interpretation and decision-making processes.

Data that were not within the acceptance limits were appended with a qualifying flag, which consists of a single or double-letter abbreviation that reflects a problem with the data. Although the qualifying flags originate during the database query process, they are included in the final data summary tables deliverable so that the data will not be used indiscriminately. The following flags were used in this text:

U - Undetected. Analyte was analyzed for but not detected above the method detection limit.

UJ - Detection limit estimated. Analyte was analyzed for, and qualified as not detected. The result is estimated.

J - Estimated. The analyte was present, but the reported value may not be accurate or precise.

R - Rejected. The data are unusable. (NOTE: Analyte/compound may or may not be present.)

Numerical sample results that are greater than the method detection limit or inorganic instrument detection limit (MDL or IDL) but less than the contract required reporting limit (CRDL) are qualified with a "J" for estimated as required by the EPA Functional Guidelines for Evaluating Data Quality.

The entire database was queried for frequency of detection in blanks and samples, detailed listing of blank detects, matrix spike/matrix spike duplicate (MS/MSD) results, field duplicate precision, surrogate recoveries, preparation and analysis dates pertaining to holding times. The queries were then manipulated to calculate necessary statistics for evaluation of the data.

Once the data review and validation process was completed, the entire data set were reviewed for chemical compound frequencies of detection, dilution factors that might affect data usability, and patterns of target compound distribution. The data set was also evaluated to identify potential data limitations, uncertainties, or both in the analytical results. Attachment A in Appendix K lists the changes in data qualifiers due to the validation processes. Attachment H in Appendix K presents all data which were rejected.

2.14.2 Holding Times

Table 3 in Appendix K reflects the data which were qualified as estimated (J or UJ) for being prepared outside of holding time criteria. None of the data were rejected for failure to meet holding times.

2.14.3 Calibration

Attachment A indicates that several organic compounds were qualified as estimated due to initial or continuing calibration deficiencies. Table 4 in Appendix K presents these data. Of the 1037 results qualified for calibration criteria outside control limits, 420 were rejected. The

rejected data applied to acetone and 2-butanone only. These compounds are identified as poor performers in the CLP SOW. All other 617 qualifications were estimated (J or UJ).

2.14.4 Method Accuracy

The laboratory control sample (LCS) reflects method accuracy. The LCS consists of deionized water spiked with target compounds or elements and processed through the entire method of preparation and analysis. All LCS recoveries met control limit criteria for these data.

2.14.5 Potential Field Sampling and Laboratory Contamination

Four types of blank samples were used to monitor potential contamination introduced during field sampling, sample handling, shipping activities, as well as sample preparation and analysis in the laboratory.

- **Trip Blank (TB):** A sample of ASTM Type II water that is prepared in the laboratory prior to the sampling event. The water is stored in VOC sample containers and is not opened in the field, and travels back to the laboratory with the other samples for VOC analysis. This blank is used to monitor the potential for sample contamination during the sample container trip. One trip blank should be included in each sample cooler that contained samples for VOC analysis. Twenty-three trip blanks were submitted to the laboratory with these samples.

- **Equipment Rinsate Blank (ERB):** A sample of the target-free water used for the final rinse during the equipment decontamination process. This blank sample is collected by rinsing the sampling equipment after decontamination and is analyzed for the same analytical parameters as the corresponding samples. This blank is used to monitor potential contamination caused by incomplete equipment decontamination. One equipment rinsate blank should be collected per day of sampling, per type of sampling equipment. Depending on the method, up to twenty-six equipment rinsate blanks were submitted to the laboratory for this field effort.

- **Field Blank or Ambient Blank (FB or AB):** The field blank is an aliquot of the source water used for equipment decontamination. This blank monitors contamination that may be introduced from the water used for decontamination. One field blank should be collected from each source of decontamination water and analyzed for the same

parameters as the associated samples. Depending on the method, up to five field blanks were collected during this sampling event.

- **Laboratory Method Blank or Method Blank (MB):** A laboratory method blank is ASTM Type II water that is treated as a sample in that it undergoes the same analytical process as the corresponding field samples. Method blanks are used to monitor laboratory performance and contamination introduced during the analytical procedure. One method blank was prepared and analyzed for every twenty samples or per analytical batch, whichever was more frequent.

According to the EPA Functional Guidelines, concentrations of common organic contaminants detected in samples at less than ten times the concentration of the associated blanks can be attributed to field sampling and laboratory contamination rather than environmental contamination from site activities. Common organic contaminants include acetone, methylene chloride, 2-butanone, and the phthalates. For other inorganic and organic contaminants, five times the concentration detected in the associated blanks (rather than ten times) is used to qualify results as potential field and/or laboratory contamination rather than environmental contamination. The ten times rule was applied on an SDG by SDG basis and not globally. EPA Region II direction does not provide for the validation contractor to use any blank value determined below the CRDL. Additionally, use of field blank data is left to the validation contractors discretion and is generally not applied, as was the case with this data set.

Field blank or global blank application would account for anomalous data which should also be attributed to laboratory or field blank contamination and, or instrument noise for many organic compounds and metals.

Attachment A (Change in Qualifiers in Appendix A) lists all changes in qualifier due to data validation and blank contamination. A comprehensive list of all detects in each blank is provided in Attachment B in Appendix K. Table 2 compiles the blank detections into a "frequency of detection" by target parameter. Additionally, Attachment G in Appendix K compiles frequency of detection by target analyte for all field samples after validation.

Eleven volatile compounds were reported in laboratory and/or field blanks. Two common disinfection byproducts (DPBP) were detected in ambient and rinsate blanks. Chloroform, a

trihalomethane (THM) was reported in all ambient and rinsate blanks. Bromodichloromethane, also a THM, was detected in ambient and rinsate blanks. Chloromethane was detected in a single ambient and rinsate blank. No field samples reported detections for these THM compounds. As Table 2 indicates, 1,1-dichloroethene, 1,2-dichloroethane, ethylbenzene, sum of m.p-xylene, o-xylene, styrene, toluene, and total xylenes were reported in a minimal number of blanks at concentration levels well below the reporting limit. No field samples were qualified by the subcontractor for these compounds.

Phthalates are used as plasticizers. The most common phthalates are bis(2-ethylhexyl) phthalate (BEHP), Di-n-butylphthalate, and Diethyl phthalate. Phthalates are often introduced into samples during handling. Gloves are often used when handling sampling equipment such as pumps, hoses, split spoons, dredges and bailers. Additionally, laboratory chemists use gloves when handling samples and extracts. Gloves are coated with plasticizers such as BEHP to facilitate release of the gloves from the skin. Table 2 in Appendix K indicates that BEHP was detected in ambient and rinsate blanks; Diethylphthalate in equipment and laboratory blanks, and Di-n-octylphthalate in a laboratory blank. Attachment A indicates that 10 and 31 samples were qualified as non-detect for BEHP and di-ethylphthalate, respectively. If global application of the flags were applied, the majority of all phthalate detections would be qualified as not detected due to contamination. Thus, caution should be utilized when making decisions based upon phthalate data.

Phenol, benzo(g,h,I)perylene, and indeno(1,2,3-c,d)pyrene were detected in a single rinsate blank at concentrations below the reporting limit. No field samples were flagged for these compounds due to blank contamination.

A single soil laboratory method blank and a single water laboratory method blank were reported to contain low levels of p,p'-DDT and PCB-1016, respectively. No field samples were qualified for blank contamination for these compounds.

As listed in Table 2 (in Appendix K), several metals were reported in either the laboratory method, equipment rinsate, and/or ambient field blanks. However, no samples were qualified due to metallic blank contamination.

2.14.6 Matrix Effects

2.14.6.1 Surrogate Spike Recovery

Surrogate spike compounds were added to every sample analyzed for the organic parameters including field and laboratory blanks as well as field environmental samples. Surrogate spikes consist of organic compounds which are similar to the method targets in chemical composition and behavior in the analytical process, but which are not normally found in environmental samples.

Surrogate spike recoveries were used to monitor both laboratory performance and matrix interferences. Surrogate spike recoveries from field and laboratory blanks were used to evaluate laboratory performance because the blanks should represent an "ideal" sample matrix. Surrogate spike recoveries for field samples were used to evaluate the potential for matrix interferences. According to Functional Guidelines, data are not qualified with respect to surrogate recoveries unless one or more volatile surrogates are out of specifications. Semivolatiles are not qualified unless two or more surrogates, within the same fraction (base/neutral or acid fraction), are out of specification.

All reported surrogate spike recoveries for field and QC samples are presented by each analytical fraction in Attachment C (Appendix K).

As Attachment C indicates, the majority of surrogate recoveries were well within method acceptance ranges. A single sample (NDA104FD1) was rejected for the 12 method 8330 compounds due to poor surrogate recovery. All other samples affected by surrogates outside control limits were estimated. The recoveries indicate that the matrix did not significantly influence the analytical method or the final analytical result.

2.14.6.2 Matrix Spike/Matrix Spike Duplicate Precision and Accuracy

A matrix spike is an aliquot of sample spiked with a known concentration of target analyte(s). The spiking occurs prior to sample preparation and analysis. The matrix spike duplicate is an intralaboratory-split sample spiked with identical concentrations of target analyte(s) as the MS. This spiking also occurs prior to sample preparation and analysis. They (the MS/MSD pair) are used to document the accuracy and precision of a method as influenced by a given sample matrix. For the MS/MSD measurement, three aliquots of a single sample are analyzed; one native sample and two spiked with target analytes or

compounds. Matrix accuracy is evaluated from the spike recoveries, while precision is evaluated from comparison of the percent recoveries of the MS and MSD. All MS/MSD precision and accuracy results are listed in Attachment D of Appendix K. Another measurement of precision is the native duplicate. This is an intralaboratory-split sample which is not spiked, but reflects the actual concentrations in the sample and its duplicate. The results are compared and precision calculated. Results which are non-detect or near the reporting limit cannot be calculated for the precision statistic. Attachment E in Appendix K presents laboratory native duplicate precision statistics.

Organic results are not qualified upon the results of MS/MSD results alone. Evaluation is in conjunction with surrogate and internal standard (if applicable) results. Additionally, many MS/MSD samples require dilution and thus the spike compounds added are diluted out and unable to be evaluated. The majority of the accuracy and precision results were well within established criteria, indicating that the specific sample matrix did not influence the overall analytical process or the final numerical sample result. No organic methods required qualification due to the MS/MSD precision and accuracy measurements indicating that the matrix did not influence the method or the final analytical result.

Inorganic results may be qualified solely upon the results of the matrix spike/matrix spike duplicate precision and accuracy. Instances where the native sample concentration for a given element exceeds the spike added concentration by a factor of four or more are disregarded as the spike added would be masked by the native concentration. According to Functional Guidelines, metals results obtained through analysis by traditional methods with recoveries of greater than 30% and outside the 75-125% recovery control limits are required to be flagged as estimated. Precision requirements for soils and waters are at 35 and 20 relative percent difference (RPD), respectively.

As Attachments D and E (Appendix K) indicate, the majority of the accuracy and precision results were well within established criteria. Only 10 barium, 9 manganese, 5 dissolved iron, and 5 mercury results were rejected due matrix spike recoveries. These data indicate that the specific sample matrix did not greatly influence the overall analytical process or the final numerical sample result.

2.14.6.3 Field Duplicate Sample Results

Field duplicate analyses measure both field and laboratory precision and can also be affected by the homogeneity of the samples. Therefore the results may have more variability than lab duplicates, which measure only lab performance. According to the EPA Functional Guidelines, there are no qualification criteria for field duplicate precision.

Dependent upon the method, there were up to ten sets of field duplicates collected during this field effort. Both the native and duplicate samples were analyzed for the same parameters.

An aqueous control limit of ± 20 percent for the RPD was used for original and duplicate sample values greater than or equal to five times the RL. Solid samples utilized a control limit of 35 RPD. A control limit of ± the RL was used if either the sample for the duplicate value was less than five times the RL for waters and 2 times the RL for soils. In the cases where only one result is above the five times the RL level and the other is below, the ± RL criteria were applied. Attachment F includes a summary of the field duplicate measurements and their associated precision statistic.

As the attachment reflects, the vast majority of the calculated precision data were within the defined control limits. Thus, the precision data indicate that matrix heterogeneity and sampling technique did not greatly influence the final numerical result.

2.14.7 Sample Results for Metals Near the Method Detection Limit (MDL)

The MDL is defined as the minimum concentration of an analyte that can be identified, measured, and reported with 99 percent confidence that the analyte concentration is greater than zero. Sample results at, or near the MDL may be false positives caused by instrument noise or low-level background shifts enhanced by a matrix, rather than a true analyte signal. Additionally, concentrations reported at up to 5 times the MDL should be recognized as lacking accuracy or precision.

2.14.7.1 PARCCs

Precision - is defined as the agreement between duplicate results, and was estimated by comparing duplicate matrix spike recoveries, native laboratory duplicates, and field duplicate sample results. MS/MSD and laboratory duplicate precision was documented as well within control limit criteria for most samples and targets. Other than the documented

exceptions, the precision between native and field duplicate sample results were within acceptable criteria for the majority of the measurements indicating that sample matrix did not significantly interfere with the overall analytical process.

Accuracy - is a measure of the agreement between an experimental determination and the true value of the parameter being measured. For the organic analyses, each of the samples was spiked with a surrogate compound; and for organic and inorganic analyses a MS/MSD, and LCS were spiked with a known reference material before preparation. Each of these approaches provides a measure of the matrix effects on the analytical accuracy. The LCS results demonstrate accuracy of the method. MS/MSD results establish precision and accuracy of the matrix. Spike recoveries were within the method acceptance limits for the majority of the measurements; therefore, other than the documented exceptions, there was no evidence of significant matrix interferences that would affect the usability of the data.

Representativeness - this criteria is a qualitative measure of the degree to which sample data accurately and precisely represent a characteristic environmental condition. Representativeness is a subjective parameter and is used to evaluate the efficacy of the sampling plan design. Representativeness was demonstrated by providing full descriptions in the project scoping documents of the sampling techniques and the rationale used for selecting sampling locations.

Completeness - is defined as the percentage of measurements that are judged to be valid compared to the to total number of measurements made. Other than the 34 non-detected acrolein results rejected for poor continuing calibration statistics as previously mentioned, no other data were rejected. A goal of 90 percent usable data was established in the project scoping document and 98 percent (60437/61685) of the data was determined to be valid.

Comparability - is another qualitative measure designed to express the confidence with which one data set may be compared to another. Factors that affect comparability are sample collection and handling techniques, sample matrix type, and analytical method. Comparability is limited by the other PARCC parameters because data sets can be compared with confidence only when precision and accuracy are known. Data from this investigation are comparable with other data collected at the site because only EPA methods

were used to analyze the sample and EPA Level III QC data are available to support the quality of the data.

2.14.8 Summary and Conclusions

Conclusions of the data quality evaluation process include:

- The laboratory analyzed the samples according to the EPA methods stated in the work plan as demonstrated by the deliverable summaries and analytical run sequences
- Sample results for metals above the IDL but less than the CRDL may be attributed to instrument noise and/or low level contamination and not site-related activities and as such may be false positives.
- Sample results for target organic compounds above the MDL but less than the RL should be considered as uncertain but indicative of the presence of that compound at an estimated concentration
- Spike recoveries, surrogates, and duplicate sample results (other than the exceptions documented in the text and attachments) indicate that the specific sample matrix did not significantly interfere with the analytical process or the final numerical result.

The project objectives or PARCCs were met, and the data can be used in the project decision-making process as qualified by the data quality evaluation process.

Tables and attachments from the Data Validation Summary are included in Appendix K.

TABLE 2-1
SUMMARY OF WELL CONSTRUCTION DETAILS
HYDROGEOLOGICAL INVESTIGATION
VIEQUES ISLAND, PUERTO RICO

Well Number	Date Installed	Top of Casing Elevation (Feet above MSL)	Boring Depth (Ft. bls)	Well Depth (Ft. bls)	PVC Riser (Ft. bls)	Screen Interval Depth (Ft. bls)	Depth to Bentonite (Ft. bls)	Depth to Sandpack (Ft. bls)
SWMU-4-MW-1	4/19/00	25.49	49.0	49.0	39.0	39-49	25.0	27.0
SWMU-4-MW-2	4/20/00	21.99	32.0	51.0	41.0	41-51	37.0	39.0
SWMU-4-MW-3	4/24/00	16.79	41.0	41.0	31.0	31-41	27.0	29.0
SWMU-4-MW-4	4/25/00	7.76	18.0	20.0	10.0	10-20	4.0	6.0
SWMU-4-MW-5	5/31/00	7.58	50.0	40.0	30.0	30-40	26.0	28.0
SWMU-4-MW-6	6/01/00	11.78	45.0	40.0	30.0	30-40	26.0	28.0
SWMU-4-MW-7	6/02/00	14.64	45.0	40.0	30.0	30-40	26.0	28.0
SWMU-4-MW-8	6/02/00	17.60	58.0	50.0	40.0	40-50	36.0	38.0
SWMU-6-MW-1	4/24/00	2.41	15.0	15.0	5.0	5-15	1.0	3.0
SWMU-6-MW-2	4/24/00	3.11	11.0	11.0	1.0	1-11	0.0	0.9
SWMU-6-MW-3	4/25/00	2.25	12.0	12.0	2.0	2-12	0.5	1.33
SWMU-6-MW-4	4/2500	2.46	11.0	11.0	1.0	1-11	0.0	0.5
SWMU-7-MW-2R	4/28/00	69.46	87.0	85.0	75.0	75-85	69.0	71.0
SWMU-7-MW-3R	5/01/00	39.03	58.0	55.0	45.0	45-55	41.0	43.0
SWMU-14-MW-1	4/04/00	47.43	70.0	70.0	60.0	60-70	56.0	58.0
SWMU-14-MW-2	4/05/00	50.93	52.0	50.0	40.0	10-50	36.0	38.0
SWMU-15-MW-1	4/14/00	50.15	53.0	53.0	43.0	43-53	29.0	31.0
AOC-C-MW-1	4/18/00	39.70	46.0	45.0	35.0	35-45	31.0	33.0
AOC-E-MW-4	4/13/00	43.60	51.0	51.0	41.0	41-51	36.0	38.0
AOC-E-MW-5	4/14/00	44.32	51.0	50.0	40.0	40-50	36.0	38.0
AOC-E-MW-6	4/17/00	44.34	46.0	50.0	40.0	40-50	32.0	34.0
AOC-F-MW-1	4/07/00	34.43	53.0	53.0	43.0	43-53	39.0	41.0
AOC-F-MW-2	4/10/00	32.15	52.0	52.0	42.0	42-52	36.0	38.0
AOC-F-MW-3	4/11/00	31.74	45.0	45.0	35.0	35-45	31.0	33.0
AOC-F-MW-4	4/12/00	31.28	52.0	52.0	42.0	42-52	36.0	38.0
AOC-F-MW-5	4/12/00	31.39	47.0	47.0	37.0	37-47	29.0	31.0

Notes:
MSL = Mean Sea Level
bls = below land surface

TABLE 2-2
WELL DEVELOPMENT RECORDS
VIEQUES ISLAND, PUERTO RICO

Well	Development Method	Development Completion Date	Approximate Gallons Developed	Number of Volumes Developed
SWMU-4-MW-1	Surge/Whale Pump	4/27/00	20	10.0
SWMU-4-MW-2	Airlift/Grundfos Pump	4/27/00	35	17.5
SWMU-4-MW-3	Airlift/Grundfos Pump	4/28/00	45	11.3
SWMU-4-MW-4	Airlift/Grundfos Pump	4/28/00	25	12.5
SWMU-4-MW-5	Swab/Grunfos Pump	6/3/00	55	9.8
SWMU-4-MW-6	Swab/Grunfos Pump	6/4/00	110	22.9
SWMU-4-MW-7	Swab/Grunfos Pump	6/4/00	55	12.7
SWMU-4-MW-8	Swab/Grunfos Pump	6/5/00	45	8.8
SWMU-6-MW-1	Peristaltic Pump	4/24/00	10	4.8
SWMU-6-MW-2	Peristaltic Pump	4/24/00	8	5.0
SWMU-6-MW-3	Peristaltic Pump	4/25/00	8	4.6
SWMU-6-MW-4	Peristaltic Pump	4/25/00	11	7.2
SWMU-7-MW-2R	Grunfos Pump	5/1/00	38	14.2
SWMU-7-MW-3R	Grunfos Pump	5/1/00	40	13.5
SWMU-14-MW-1	Surge/Whale Pump	4/27/00	50	11.1
SWMU-14-MW-2	Surge/Whale Pump	4/26/00	9	6.0
SWMU-15-MW-1	Surge/Whale Pump	4/25/00	35	53.5
AOC-C-MW-1	Surge/Grunfos Pump	4/25/00	36	20.5
AOC-E-MW-4	Surge/Whale Pump	4/26/00	18	7.8
AOC-E-MW-5	Surge/Whale Pump	4/27/00	8	4.1
AOC-E-MW-6	Surge/Whale Pump	4/26/00	36	24.0
AOC-F-MW-1	Surge/Grundfos Pump	4/17/00	80	22.2
AOC-F-MW-2	Surge/Grundfos Pump	4/18/00	56	14.0
AOC-F-MW-3	Surge/Grundfos Pump	4/19/00	56	18.7
AOC-F-MW-4	Surge/Grunfos Pump	4/19/00	55	13.8
AOC-F-MW-5	Surge/Grunfos Pump	4/18/00	68	22.3

TABLE 2-3
WATER LEVEL MEASUREMENTS
VIEQUES ISLAND, PUERTO RICO

Well No.	Date	Elevation (feet msl)	Depth to Water (feet)	Groundwater Level (feet msl)
S-4-MW1	8/18/00	25.49	27.5	-2.01
S-4-MW2	8/18/00	21.99	22.85	-0.86
S-4-MW3	8/18/00	16.79	17.78	-0.99
S-4-MW4	8/18/00	7.76	8.35	-0.59
S-4-MW5	8/18/00	7.58	9.09	-1.51
S-4-MW6	8/18/00	11.78	11.48	0.3
S-4-MW7	8/18/00	14.64	14.94	-0.3
S-4-MW8	8/18/00	17.6	18.52	-0.92
S-6-MW1	5/3/00	2.41	4	-1.59
S-6-MW2	5/3/00	3.11	4.65	-1.54
S-6-MW3	5/3/00	2.25	3.62	-1.37
S-6-MW4	5/3/00	2.46	3.97	-1.51
S-7-MW1	5/3/00	41.72	40.16	1.56
S-7-MW2	5/3/00	69.46	68.15	1.31
S-7-MW3	5/3/00	39.03	39.2	-0.17
S14-MW1	5/3/00	50.93	43.46	7.47
S14-MW2	5/3/00	47.43	40.28	7.15
S15-MW1	5/3/00	50.15	39.58	10.57
A-C-MW1	5/3/00	39.7	34.28	5.42
A-E-MW1	5/3/00	43.93	38.39	5.54
A-E-MW2	5/3/00	42.68	37.28	5.4
A-E-MW3	5/3/00	44.06	37.72	6.34
A-E-MW4	5/3/00	43.6	37.36	6.24
A-E-MW5	5/3/00	44.32	38.05	6.27
A-E-MW6	5/3/00	44.34	38.1	6.24
A-F-MW1	5/3/00	34.43	30.78	3.65
A-F-MW2	5/3/00	32.15	29.02	3.13
A-F-MW3	5/3/00	31.74	28.5	3.24
A-F-MW4	5/3/00	31.28	28.25	3.03
A-F-MW5	5/3/00	31.39	28.3	3.09

TABLE 2-4
SURVEY DATA
VIEQUES ISLAND, PUERTO RICO

SWMU-4			
STATION	**LATITUDE**	**LONGITUDE**	**ELEVATION**
W4-MW01	18^ 06' 02.007206" N	65^ 34' 15.105179" W	25.49'
W4-MW02	18^ 05' 59.851196" N	65^ 34' 13.137493" W	21.99'
W4-MW03	18^ 05' 57.783599" N	65^ 34' 14.906479" W	16.79'
W4-MW04	18^ 05' 56.437920" N	65^ 34' 15.410537" W	7.76'
SB-1	18^ 05' 59.882892" N	65^ 34' 14.357105" W	20.72'
SB-2	18^ 05' 59.786523" N	65^ 34' 14.036138" W	20.36'
SB-3	18^ 05' 59.722386" N	65^ 34' 13.755749" W	18.83'
SB-4	18^ 05' 57.966236" N	65^ 34' 15.347900" W	17.88'
SB-5	18^ 05' 57.900362" N	65^ 34' 15.170411" W	15.52'
SB-6	18^ 05' 57.758101" N	65^ 34' 14.861739" W	14.03'
SB-7	18^ 05' 56.735863" N	65^ 34' 15.708978" W	8.62'
SB-8	18^ 05' 56.653220" N	65^ 34' 15.463228" W	5.59'
SB-9	18^ 05' 56.398786" N	65^ 34' 15.183961" W	4.52'
SB-10	18^ 05' 56.227888" N	65^ 34' 14.977517" W	4.84'
SB-11	18^ 06' 02.142753" N	65^ 34' 14.728551" W	22.51'
SB-12	18^ 06' 02.182947" N	65^ 34' 14.375163" W	22.97'

SWMU-5			
STATION	**LATITUDE**	**LONGITUDE**	**ELEVATION**
W5-SB01	18 06 03.170	65 32 21.919	111.24
W5-SB02	18 06 03.093	65 32 21.983	109.86
W5-SB03	18 06 03.023	65 32 22.034	109.90
W5-SB04	18 06 02.947	65 32 22.096	109.75

SWMU-6			
STATION	**LATITUDE**	**LONGITUDE**	**ELEVATION**
SWMU-6-MW01	18^ 07' 02.368650" N	65^ 33' 40.790472" W	2.41'
SWMU-6-MW02	18^ 07' 03.782243" N	65^ 33' 42.117861" W	3.11'
SWMU-6-MW03	18^ 07' 04.216331" N	65^ 33' 41.318848" W	2.25'
SWMU-6-MW04	18^ 07' 04.087294" N	65^ 33' 40.293935" W	2.46'
2SB-01	18^ 07' 03.897884" N	65^ 33' 41.262330" W	-1.38'
2SB-02	18^ 07' 04.348666" N	65^ 33' 40.673820" W	-1.43'
2SB-03	18^ 07' 02.882766" N	65^ 33' 41.633897" W	-0.22'
2SB-04	18^ 07' 03.178419" N	65^ 33' 40.913497" W	-0.88'
2SB-05	18^ 07' 03.349855" N	65^ 33' 40.547464" W	-1.25'
2SB-06	18^ 07' 02.111360" N	65^ 33' 41.223423" W	0.25'
2SB-07	18^ 07' 02.533890" N	65^ 33' 40.710841" W	-0.11'

TABLE 2-4
SURVEY DATA
VIEQUES ISLAND, PUERTO RICO

2SB-08	18^ 07' 02.844313" N	65^ 33' 40.169921" W	-0.54'
2SE-01	18^ 07' 01.663237" N	65^ 33' 41.450429" W	-4.72'
2SE-02	18^ 07' 02.512434" N	65^ 33' 41.994799" W	-3.98'
2SE-03	18^ 07' 04.338842" N	65^ 33' 42.178483" W	-4.10'
2SE-04	18^ 07' 04.495766" N	65^ 33' 41.807115" W	-3.90'
2SE-05	18^ 07' 04.609965" N	65^ 33' 41.346993" W	-3.53'
2SE-06	18^ 06' 58.669199" N	65^ 33' 43.519537" W	-4.72'
2SE-07	18^ 06' 59.713631" N	65^ 33' 37.172966" W	-4.58'

SWMU-7			
STATION	**LATITUDE**	**LONGITUDE**	**ELEVATION**
SB-01	18^ 07' 02.325536" N	65^ 32' 09.800283" W	76.34'
SB-02	18^ 07' 02.174624" N	65^ 32' 09.863476" W	64.92'
SB-03	18^ 07' 03.094542" N	65^ 32' 10.752333" W	61.46'
SB-04	18^ 07' 03.005450" N	65^ 32' 10.895420" W	52.22'
SB-05	18^ 07' 04.175940" N	65^ 32' 11.252262" W	57.84'
SB-06	18^ 07' 04.211148" N	65^ 32' 11.490527" W	47.57'
W7-SD01	18^ 07' 02.038613" N	65^ 32' 09.733123" W	61.57'
W7-SD02	18^ 07' 04.254503" N	65^ 32' 11.651686" W	38.53'
W7-SD03	18^ 07' 10.131205" N	65^ 32' 16.777682" W	21.25'
W7-MW01	18^ 07' 10.074963" N	65^ 32' 13.903800" W	41.72'
W7-MW02R	18^ 07' 04.363658" N	65^ 32' 10.940662" W	69.46'
W7-MW03R	18^ 07' 10.100450" N	65^ 32' 16.127643" W	39.03'

SWMU10			
STATION	**LATITUDE**	**LONGITUDE**	**ELEVATION**
SB-01	18^ 07' 25.258609" N	65^ 31' 27.102147" W	43.51
SB-02	18^ 07' 25.395983" N	65^ 31' 27.083862" W	43.03
SB-03	18^ 07' 25.492094" N	65^ 31' 27.146321" W	42.92
SB-04	18^ 07' 25.596499" N	65^ 31' 27.223644" W	42.29
SB-05	18^ 07' 25.588500" N	65^ 31' 27.341036" W	42.43
SB-06	18^ 07' 25.515968" N	65^ 31' 27.437390" W	42.53
SB-07	18^ 07' 25.410057" N	65^ 31' 27.387372" W	42.63
SB-08	18^ 07' 25.331607" N	65^ 31' 27.371505" W	42.81
SB-09	18^ 07' 25.276376" N	65^ 31' 27.291099" W	42.87
SB-10	18^ 07' 25.233870" N	65^ 31' 27.206710" W	43.23

TABLE 2-4
SURVEY DATA
VIEQUES ISLAND, PUERTO RICO

SWMU14			
STATION	**LATITUDE**	**LONGITUDE**	**ELEVATION**
SB-01	18^ 07' 23.652861" N	65^ 31' 30.271335" W	46.71
SB-02	18^ 07' 23.873976" N	65^ 31' 30.370409" W	46.30
SB-03	18^ 07' 24.051616" N	65^ 31' 30.460209" W	45.70
SB-04	18^ 07' 24.200800" N	65^ 31' 30.548663" W	44.95
SB-05	18^ 07' 24.272879" N	65^ 31' 30.542406" W	44.56
SB-06	18^ 07' 24.132197" N	65^ 31' 30.748760" W	45.94
SB-07	18^ 07' 23.969771" N	65^ 31' 30.678026" W	47.35
SB-08	18^ 07' 24.418349" N	65^ 31' 31.104540" W	43.95
SB-09	18^ 07' 24.204518" N	65^ 31' 30.884437" W	42.68
SB-10	18^ 07' 24.044689" N	65^ 31' 30.874072" W	47.48
SB-11	18^ 07' 23.923885" N	65^ 31' 30.818929" W	47.48
SB-12	18^ 07' 23.699982" N	65^ 31' 30.533995" W	47.68
SB-13	18^ 07' 23.785636" N	65^ 31' 30.614865" W	47.83
W14-MW01	18^ 07' 24.517886" N	65^ 31' 31.209748" W	47.43
W14-MW02	18^ 07' 22.409306" N	65^ 31' 30.140281" W	50.93

SWMU15			
STATION	**LATITUDE**	**LONGITUDE**	**ELEVATION**
SB-01	18^ 07' 23.355528" N	65^ 31' 30.457697" W	49.01
SB-02	18^ 07' 23.677040" N	65^ 31' 30.639962" W	48.36
SB-03	18^ 07' 23.980215" N	65^ 31' 30.866033" W	47.15
SB-04	18^ 07' 24.247323" N	65^ 31' 31.102129" W	46.07
SB-05	18^ 07' 24.469171" N	65^ 31' 31.314559" W	44.80
SB-06	18^ 07' 24.066870" N	65^ 31' 31.585598" W	46.38
SB-07	18^ 07' 23.825763" N	65^ 31' 31.455551" W	47.30
SB-08	18^ 07' 23.497436" N	65^ 31' 31.299481" W	48.37
SB-09	18^ 07' 23.150251" N	65^ 31' 31.175805" W	49.54
SB-10	18^ 07' 22.986715" N	65^ 31' 31.496083" W	50.19
SB-11	18^ 07' 23.322996" N	65^ 31' 31.648936" W	48.85
SB-12	18^ 07' 23.689588" N	65^ 31' 31.813734" W	47.34
SB-13	18^ 07' 23.159582" N	65^ 31' 32.032398" W	49.31
SB-14	18^ 07' 22.862210" N	65^ 31' 31.837804" W	50.25
SB-15	18^ 07' 22.829143" N	65^ 31' 32.248437" W	50.20
SB-16	18^ 07' 22.638750" N	65^ 31' 32.410534" W	50.15
W15-MW01	18^ 07' 22.638750" N	65^ 31' 32.410534" W	50.15

TABLE 2-4
SURVEY DATA
VIEQUES ISLAND, PUERTO RICO

AOC-C			
STATION	**LATITUDE**	**LONGITUDE**	**ELEVATION**
SB-01	18^ 07' 27.470401" N	65^ 31' 29.556136" W	32.39
SB-02	18^ 07' 28.423657" N	65^ 31' 29.893709" W	28.79
SB-03	18^ 07' 29.616515" N	65^ 31' 30.367937" W	26.51
SB-04	18^ 07' 30.820604" N	65^ 31' 30.816377" W	23.61
SB-05	18^ 07' 32.003382" N	65^ 31' 31.278235" W	20.08
SB-06	18^ 07' 33.132809" N	65^ 31' 31.614726" W	17.63
SB-07	18^ 07' 34.383735" N	65^ 31' 31.896048" W	13.51
SB-08	18^ 07' 27.454541" N	65^ 31' 30.078434" W	32.97
SB-09	18^ 07' 28.364766" N	65^ 31' 30.425854" W	30.05
SB-10	18^ 07' 29.409342" N	65^ 31' 30.889486" W	26.85
SB-11	18^ 07' 30.536538" N	65^ 31' 31.356842" W	23.89
SB-12	18^ 07' 31.682530" N	65^ 31' 31.755462" W	21.74
SB-13	18^ 07' 32.858993" N	65^ 31' 32.253399" W	19.57
SB-14	18^ 07' 34.042010" N	65^ 31' 32.677087" W	15.86
SB-15	18^ 07' 34.979152" N	65^ 31' 32.159395" W	9.51
SB-16	18^ 07' 25.683458" N	65^ 31' 29.910251" W	41.72
SB-17	18^ 07' 25.764978" N	65^ 31' 29.985634" W	41.68
SB-18	18^ 07' 25.814501" N	65^ 31' 29.838493" W	41.34
SB-19	18^ 07' 25.899174" N	65^ 31' 29.999750" W	40.68
AC-MW01	18^ 07' 25.982911" N	65^ 31' 29.893693" W	39.70

AOC-E			
STATION	**LATITUDE**	**LONGITUDE**	**ELEVATION**
AE-MWE01	18^ 07' 24.702237" N	65^ 31' 30.539691" W	43.93'
AE-MWE02	18^ 07' 25.246643" N	65^ 31' 30.794733" W	42.68'
AE-MWE03	18^ 07' 24.538020" N	65^ 31' 30.459919" W	44.06'
AE-MWE04	18^ 07' 24.773106" N	65^ 31' 30.684290" W	43.60'
AE-MWE05	18^ 07' 24.785336" N	65^ 31' 30.508099" W	44.32'
AE-MWE06	18^ 07' 24.931917" N	65^ 31' 30.158582" W	44.34'

AOC-F			
STATION	**LATITUDE**	**LONGITUDE**	**ELEVATION**
SB-01	18^ 07' 27.731018" N	65^ 31' 32.883056" W	33.52
SB-02	18^ 07' 27.564603" N	65^ 31' 33.001865" W	33.96
SB-03	18^ 07' 27.641145" N	65^ 31' 33.111438" W	34.06
SB-04	18^ 07' 27.738325" N	65^ 31' 33.049773" W	33.01
AF-MW01	18^ 07' 27.365361" N	65^ 31' 32.977782" W	34.43
AF-MW02	18^ 07' 27.905862" N	65^ 31' 33.187283" W	32.15
AF-MW03	18^ 07' 27.855278" N	65^ 31' 33.514335" W	31.74
AF-MW04	18^ 07' 25.291943" N	65^ 31' 31.072152" W	31.28
AF-MW05	18^ 07' 28.133689" N	65^ 31' 33.219063" W	31.39

TABLE 2-5
Federally Listed Species Potentially Occurring at NASD, Vieques
NASD, Vieques Island, Puerto Rico

Scientific Name	Common Name	Federal Status
Plants		
Chamaecrista glandulosa var. *mirabilis* (Herb)	Jamaican broom	Endangered
Stahlia monosperma	Cobana negra	Threatened
Calyptranthes thomasiana	Thomas' lidflower	Endangered
Eugenia woodburyana	Woodbury's stopper	Endangered
Reptiles and Amphibians		
Chelonia mydas	Green sea turtle	Threatened
Dermochelys coriacea	Leatherback sea turtle	Endangered
Eretmochelys imbricata	Hawksbill sea turtle	Endangered
Birds		
Falco peregrinus tundrius	Arctic peregrine falcon	Threatened
Pelecanus occidentalis occidentalis	Brown pelican	Endangered
Sterna dougalli dougalli	Roseate tern	Endangered
Mammals		
Physeter macrocephalus	Sperm whale	Endangered
Balaenoptera physalus	Fin whale	Endangered
Megaptera novaeangliae	Humpback whale	Endangered
Trichechas manatus	West Indian manatee	Endangered

Source: NASD, 1996

SECTION 3

SWMU 04 Inactive Waste Explosive Open Burn/Detonation Range

This section presents the results of the Expanded PA/SI investigation performed at SWMU 04 – Inactive Waste Explosive Open Burn/Detonation Range at NASD, Vieques, Puerto Rico. The field sampling activities associated with this investigation were performed by CH2M HILL in April and June, 2000.

This section includes a description of the objectives of the Expanded PA/SI, a site description, results of previous investigations, summary of field activities, summary of laboratory results, and conclusions and recommendations. To evaluate the potential for environmental impacts, data were compared to applicable regulatory screening and preliminary background values. A description of the environmental screening process was presented in Section 2.14 of this report.

3.1 Objectives

The specific objectives of this investigation were to:

1. Determine if a release of hazardous materials has occurred as a result of site-related activities; and
2. Assess whether the site is a candidate for closeout as a NFRAP site, or
3. Determine if further investigation or evaluation are warranted at this SWMU.

3.2 Site Description

The inactive open burn/detonation unit (SWMU 04) was utilized for thermal destruction of waste munitions, fuels or propellants. The material to be burned was placed in the open burn area and a squib or other detonator was placed in the waste material. The open burn was then initiated from a safe distance using electrical detonation. In addition, material from the rework of munitions (loose powder and primers) and flares and cartridge-activated devices may also have been disposed at the unit (IAS, 1984). The inactive open

burn/detonation area reportedly has been swept for live munitions by an Explosive Ordnance Demolition (EOD) team from NASD.

SWMU 04 is approximately 0.5 miles long and 200 yards wide, and is located approximately 0.5 miles from the Caribbean Sea in the southwest corner of Vieques Island (Figure 1-2). An IAS report indicates that this unit may have been used as early as the 1940s, and it is known to have been operated from 1969 to approximately 1979. SWMU 04 has been inactive since the early 1980s.

3.2.1 Summary of Qualitative Ecological Survey

The majority of SWMU 4 has a dense shrub canopy of thorny shrubs and a scattered herbaceous stratum. The total vegetative cover was approximately 75-95 percent. Dominant shrubs identified on the site included *Acacia farnenciana, Prosopis glandulosa, Pithlcellobium dulce,* and *Zanthoxylum brevipes.* Another co-dominant shrub was *Leucaena leucocephala.* The herbaceous stratum was dominated by *Bothriochloa ischaemum, Commelina erecta, C. diffusa,* and *Lasiacis divaricata.* No endangered or threatened plant species were observed during the field survey.

Although some debris was found at SWMU 4, there was little apparent evidence of past military activities based on the density of the plant community. Isolated clearings within the plant communities and worn trails from horses (*Equus caballus*) that occasionally graze throughout the site were noted within the SWMU area. No plant stresses were observed in SWMU 4.

During the wildlife surveys conducted on this site, a few wildlife species (mainly birds) were observed utilizing the habitat. No endangered or threatened wildlife species were observed during the survey. Although no individual horses were observed within the site, there was sufficient evidence to indicate that horses use this habitat. The bird species observed consisted of coastal forest and shore species due to the close proximity to the ocean. Numerous lizards (*Anolis* species) were also observed. Wildlife that was observed at SWMU 4 included horses, mongoose, bananaquit, common-ground dove, smooth-billed ani, adelaidae warbler, yellow warbler, pearly-eyed thrasher, greater antillean grackle, puerto rican lizard cuckoo, loggerhead kingbird, and gray kingbird. There was no evidence that the historic activities from this SWMU have had an impact on wildlife or its habitat.

3.3 Previous Investigation Results

No previous environmental investigations have been performed at SWMU 04.

3.4 Expanded PA/SI Field Investigations

The Expanded PA/SI for SWMU 04 was conducted in two mobilizations beginning in April 2000 and ending in June 2000. The field investigation included geophysical surveys, unexploded ordnance (UXO) clearance, installation and sampling of eight monitoring wells, and collection of surface soil and subsurface soil samples from 12 borings. All samples were analyzed for metals, VOCs, SVOCs, pesticides, PCBs, and explosives. Figure 3-1 is a site map of SWMU 04 with the soil and groundwater sampling locations.

3.4.1 Geophysical Survey

The site is overgrown with vegetation, and as a result, locating the actual burn pit areas was very difficult. Historical aerial photographs were examined to help identify the former burn areas. In April 2000, a surface geophysical survey using a magnetometer was performed to help locate potential areas of metallic debris to help identify the former burn areas. A bulldozer was used to cut nine transects in the suspected area of the former burn pit for the geophysical survey. The surface geophysical survey identified an area with potential buried metal. These results were used to located placement of 12 soil borings and four monitoring wells (one upgradient and three downgradient) during the initial phase of the investigation conducted in April 2000.

Additional bulldozer work, UXO avoidance surveys, magnetometer surveying, soil sampling, and monitoring well installation was conducted at SWMU 04 during a second mobilization in June 2000. The initial nine transects were expanded to the west and additional transects were cut north of the original investigation area in an attempt to delineate the extent of UXO in the area. The magnetometer survey was extended along the additional transects. Again, the surface geophysical survey identified areas with potential buried metal. The results of the second surface geophysical survey were used to locate placement of an additional four monitoring wells and soil borings west of the original investigation. Results of the magnetometer survey are included in Appendix G.

3.4.2 Unexploded Ordnance Clearance

During the geophysical surveys, UXO technicians were contracted to perform UXO avoidance surveys. The UXO technicians cleared the transects before the magnetometer survey was conducted. Various small UXO was found near the surface during the surveys by the UXO technicians. UXO reports are included in Appendix H.

3.4.3 Monitoring Well Installation and Sampling

Based on the results of the magnetometer surveys, a total of eight monitoring wells were installed to assess if groundwater has been impacted. During the initial mobilization of the field work conducted in April 2000, one monitoring well was installed upslope and three downslope from the anomalous areas of potential buried metal.

During the second mobilization of field work conducted in June 2000, four additional monitoring wells were installed around a perimeter road to the former OB/OD area (where more anomalous areas of potential buried metal were found) to evaluate if contamination was detected along the perimeter of the site.

Prior to sampling, the depths to groundwater were measured using an electronic water level indicator. These data were used in conjunction with the survey data to determine elevations of groundwater at each monitoring well. As shown in Figure 3-2, the groundwater flow direction is to the northeast.

3.4.4 Soil Sampling

Twelve soil borings were installed in the area of the initial magnetometer survey. Soil borings were located down-slope of potential buried metal anomalies based on the magnetometer survey. One surface soil sample and one subsurface soil (5-foot) sample were collected from each of the 12 soil borings. In addition to laboratory analysis, soil samples were screened in the field for organic vapors using an organic vapor meter (OVM).

3.5 Field Screening Results

Soil samples were screened in the field for VOCs using an OVM. This field screening method provides a qualitative evaluation of potential organic constituents in soil. The OVM results for the site are summarized in Appendix B. The results indicate that the highest OVM reading was 28 parts per million (ppm). Most OVM readings were 0.0 ppm.

3.6 Laboratory Analytical Results

The following section presents the interpretation of the analytical data from the SWMU 04 Expanded PA/SI investigation. The discussion includes the identification of screening/regulatory criteria exceedances, as well as exceedances of upgradient, background, and offsite concentrations for the individual media sampled. Conclusions and recommendations, by media, are presented in Section 3.7.

Concentrations of detected chemicals were compared to the following current USEPA screening criteria for each matrix: residential and industrial risk-based concentrations (RBCs) and soil screening levels for soil; and tap water RBCs and drinking water Maximum Contaminant Levels (MCLs) for groundwater. Preliminary background criteria were obtained from data collected from Camp Garcia (Baker Environmental, Inc., November 1999).

Appendix I contains a compilation of the concentrations for all chemicals for which samples were analyzed. Appendix J contains a data validation summary.

3.6.1 Groundwater Results

Analytical results from unfiltered (total metals) samples indicate detections of aluminum, barium, cadmium, chromium, iron, manganese, nickel, selenium, vanadium, and zinc, in groundwater samples at concentrations exceeding the MCL and/or the tap water RBC criteria. Filtered metals (dissolved) results show detections of aluminum, barium, cadmium, chromium, copper, manganese, nickel, selenium, silver, and vanadium above screening criteria.

Monitoring wells SWMU 04, SWMU 05, SWMU 06, SWMU 07, AND SWMU 08 were installed near the coast line within the seawater zone of the aquifer. Seawater contains naturally high concentrations of metals.

VOCs, SVOCs, pesticides, and PCBs were either not detected, or were detected at concentrations below their applicable screening criteria. Table 3-1 summarizes the groundwater detections, which are presented graphically on Figure 3-3.

3.6.2 Surface Soil Results

Analytical results indicate detections of aluminum, arsenic, iron, lead, thallium, vanadium, 2,4,6-trinitrotoluene, 2,4-dinitrotoluene, and hexahydro-1,3,5-trinitro-1,3,5,7-tetrazocine in surface soil samples at concentrations above the residential RBC and/or leachability screening criteria.

Arsenic and vanadium were not detected above background criteria and therefore are not likely to be site-related. While iron and thallium were detected above the screening criteria and were not analyzed in background samples, these analytes were also detected in most samples collected at NASD at similar concentrations, indicating that these detections are likely representative of background for NASD and are not site-related. The detection of aluminum at W4-SB04 and lead at W4-SB06 were appreciably higher than the other samples, and may be attributed to site activities.

The explosive derived constituents 2,4,6-trinitrotoluene, 2,4-dinitrotoluene, and hexahydro-1,3,5-trinitro-1,3,5,7-tetrazocine were detected above the residential RBCs and/or leachability criteria, and are likely attributed to site activities.

VOCs, SVOCs, pesticides, and PCBs were either not detected, or were detected at concentrations below their applicable screening criteria. Table 3-2 summarizes the surface soil detections, which are presented graphically on Figure 3-4.

3.6.3 Subsurface Soil Results

Arsenic and barium were detected in SWMU4-SB05 at a concentrations which exceeded their respective leachability criteria as well as preliminary background concentrations. However, because these metals were detected in all samples collected at the site it is likely that the detected concentrations of these metals in SWMU04-SB05 are representative of background for NASD and are not site-related.

VOCs, SVOCs, pesticides, PCBs, and explosives were either not detected, or were detected at concentrations below their applicable screening criteria. Table 3-3 summarizes the subsurface soil detections, which are presented graphically on Figure 3-4.

3.7 Conclusions and Recommendations

This section summarizes the results of the expanded PA/SI activities by media, and provides recommendations for each media sampled. The data indicate that the metals detected in groundwater and subsurface soil are indicative of site background levels. Additional background studies will be conducted in November 2000 to verify background levels of metals in soils at NASD.

3.7.1 Groundwater

Analytical results of groundwater samples indicated detections of metals above the tap water RBCs and/or MCLs. The detected metals in monitoring wells SWMU 04, SWMU 05, SWMU 06, SWMU 07, AND SWMU 08 may be due to the influences of seawater. VOCs, SVOCs, and PCBs were either not detected, or were detected at concentrations below their applicable screening criteria.

No evidence exists to suggest that a release of hazardous materials to groundwater has occurred as a result of site-related activities. However, an additional background groundwater investigation is recommended to better identify naturally occurring metals concentrations at the site.

3.7.2 Surface Soil

Analytical results of surface soil samples indicated detections of metals and explosives above the preliminary background, residential RBCs, and/or leachability criteria. Some of the detected explosives are likely the result of site-related activities. In addition, UXO identified at the site is likely the result of site-related activities. The extent of UXO should be delineated and the location of the OB/OD trenches should be defined in the primary area of 40 to 50 acres. For human health and safety reasons, the UXO area should be fenced off and warning signs placed around the site, including the off-shore area. Roving security patrols should be employed to maintain the perimeter security.

Evidence exists to suggest that a release of site-related materials to surface soil has occurred as a result of site-related activities. It is recommended that a Full RI/FS including a risk assessment be conducted at the site. As part of the RI, additional surface soil samples should be collected to delineate the extent of the explosive constituents.

3.7.3 Subsurface Soil

Metals were detected in subsurface soil samples at concentrations indicative of site background levels. All other parameters were either not detected, or were detected below their applicable screening criteria.

No evidence exists to suggest that a release of hazardous materials to subsurface soil has occurred at this site as a result of site-related activities. However, an additional soil background investigation is recommended to characterize the background metal concentrations within the soils at NASD.

Table 3-1
Groundwater Analytical Data Summary
SWMU 4, NASD - Vieques, PR

StationID					SWMU4-MW01	SWMU4-MW02	SWMU4-MW03	SWMU4-MW04	SWMU4-MW05	SWMU4-MW06	SWMU4-MW07	SWMU4-MW08
SampleID					NDA001	NDA003	NDA004	NDA002	NDB010	NDB011	NDB013	NDB014
Date Collected		Screening Criteria			04/28/2000 9:10	04/27/2000 14:45	04/27/2000 14:00	04/27/2000 11:40	06/12/2000 15:00	06/12/2000 11:00	06/12/2000 15:20	06/12/2000 11:45
Paramater Name	Units	BKG	Federal MCL (M)	Tapwater RBC (T)								
Dissolved Metals												
ALUMINUM, DISSOLVED	MG/L		0.05	3.65	0.0278 J	0.0258 U	0.0258 U	0.0258 U	38.3 J MT	42.4 J MT	28 J MT	25.8 U
BARIUM, DISSOLVED	MG/L	0.28	2.00	0.255	0.445 = - T	0.257 = - T	0.6 = - T	0.904 = - T	193 J M T	335 = M T	238 = M T	838 = M T
CALCIUM, DISSOLVED	MG/L				450 =	96.8 J	1050 J	1020 J	804000 R	692000 R	910000 R	100000 =
CADMIUM, DISSOLVED	MG/L	0.0040	0.0050	0.0018	0.0022 J - T	0.00025 J - T	0.0035 J - T	0.0043 J - T	0.2 U	0.2 U	0.2 U	0.2 U
CHROMIUM, DISSOLVED	MG/L	0.02	0.10	0.11	0.004 J	0.00083 J	0.0019 J	0.0011 J	0.5 U	0.5 U	0.5 U	1.6 J M T
COPPER, DISSOLVED	MG/L	0.04	1.00	0.15	0.0019 U	0.0055 J	0.0044 J	0.0041 J	3.3 J MT	3.2 J MT	2.9 J MT	3 J MT
IRON, DISSOLVED	MG/L		0.30	1.10	0.0122 J	0.0122 U	0.0122 U	0.0122 U	12.2 U	12.2 U	12.2 U	12.2 U
LEAD, DISSOLVED	MG/L		0.01		0.0011 U	0.0034 =	0.004 =	0.0052 =	1.1 U	1.1 U	1.1 U	1.1 U
MAGNESIUM, DISSOLVED	MG/L				527 =	50.8 =	727 =	712 =	488000 =	476000 =	666000 R	137000 =
MANGANESE, DISSOLVED	MG/L		0.05	0.07	0.0326 =	0.535 = M T	0.131 =	1.44 = M T	1750 = MT	1040 = MT	2700 = MT	7210 = MT
MERCURY, DISSOLVED	MG/L		0.0020	0.0011	0.00018 U	0.00018 U	0.00028 =	0.00018 U	0.18 U	0.18 U	0.18 U	0.18 U
NICKEL, DISSOLVED	MG/L	0.02	0.10	0.07	0.0061 J	0.0008 U	0.0031 J	0.0019 J	3.8 J MT	3.8 J MT	5.9 J MT	6.4 J MT
POTASSIUM, DISSOLVED	MG/L				12.5 J	6.56 J	18.8 J	29.8 J	28600 J	16800 J	14900 J	10500 J
SELENIUM, DISSOLVED	MG/L	0.02	0.05	0.02	0.0068 =	0.0021 U	0.0041 J	0.0021 U	2.1 U	2.1 U	2.1 U	2.9 J MT
SILVER, DISSOLVED	MG/L		0.10	0.02	0.0005 U	0.0005 U	0.00053 J	0.0005 U	0.61 J MT	0.5 U	0.5 U	0.5 U
SODIUM, DISSOLVED	MG/L				3070 J	1040 J	3460 J	1830 J	4140000 R	2950000 R	1980000 R	1650000 R
VANADIUM, DISSOLVED	MG/L	0.04		0.03	0.0047 J	0.0121 J	0.0042 J	0.0037 J	3.8 J MT	4.4 J MT	3.3 J MT	5 J MT
ZINC, DISSOLVED	MG/L	0.14	5.00	1.10	0.0308 =	0.0109 J	0.0081 J	0.0088 J	2.5 U	2.5 U	2.5 U	2.5 U
Total Metals												
ALUMINUM	MG/L		0.05	3.65	2.9 = M -	0.635 J M -	1.65 J M -	5.42 J M T	219 J MT	1770 J MT	7700 J MT	8580 J MT
BARIUM	MG/L	0.28	2.00	0.26	0.486 = - T	0.28 = - T	0.671 = - T	0.943 = - T	219 = MT	407 = MT	404 = MT	952 = MT
CADMIUM	MG/L	0.0040	0.0050	0.0018	0.002 J - T	0.00038 J	0.0036 J - T	0.0046 J - T	0.2 U	0.2 U	0.2 U	0.2 U
CALCIUM	MG/L				435 =	103 J	1090 J	1020 J	831000 R	694000 R	915000 R	98700 =
CHROMIUM, TOTAL	MG/L	0.02	0.10	0.11	0.0147 =	0.0014 J	0.0049 J	0.0036 J	0.55 J MT	1.1 J MT	2 J MT	3.8 J MT
COBALT	MG/L	0.02		0.22	0.0005 U	0.00056 J	0.00052 J	0.0035 J	1.9 J	2.1 J	8.8 J	9.8 J
COPPER	MG/L	0.04	1.00	0.15	0.0033 J	0.0047 J	0.0042 J	0.0108 J	4.4 J	4.7 J	8.9 J	123 =
IRON	MG/L		0.30	1.10	1.83 J M T	0.488 = M -	1.23 = M T	4.6 = M T	86.1 J	1480 J	7090 J	8080 J
LEAD	MG/L		0.01		0.0018 J	0.002 J	0.0042 =	0.0067 =	1.1 U	1.8 J	2.7 J	7.6 =
MAGNESIUM	MG/L				510 =	52 =	751 =	697 =	551000 R	481000 J	672000 R	133000 =
MANGANESE	MG/L		0.05	0.07	0.154 = M T	0.56 = M T	0.217 = M T	1.68 = M T	1920 =	1260 =	3170 =	7380 =
MERCURY	MG/L		0.0020	0.0011	0.00018 U	0.00018 U	0.00018 U	0.00018 U	0.18 U	0.18 U	0.18 U	0.18 U
NICKEL	MG/L	0.02	0.10	0.07	0.0118 J	0.001 J	0.0048 J	0.0038 J	3.3 J MT	4.2 J MT	7.2 J MT	8.1 J MT
POTASSIUM	MG/L				14.4 J	6.99 J	20.1 J	30 J	30000 J	17800 J	16600 J	11600 J
SELENIUM	MG/L	0.02	0.05	0.02	0.0054 =	0.0021 U	0.0037 J	0.0048 J	2.1 U	2.1 U	2.4 J MT	2.9 J MT
SILVER	MG/L		0.10	0.02	0.0005 U	0.0005 U	0.0005 U	0.00065 J	0.81 J MT	0.82 J MT	0.5 U	0.5 U
SODIUM	MG/L				3090 J	1040 J	3550 J	1810 J	4210000 R	2970000 R	2020000 R	1630000 R
VANADIUM	MG/L	0.04		0.03	0.0093 J	0.0142 J	0.0075 J	0.0157 J	3.9 J MT	7.2 J MT	21.4 J MT	24.9 J MT
ZINC	MG/L	0.14	5.00	1.10	0.0384 =	0.0081 J	0.0185 J	0.0395 =	2.5 U	2.5 U	29.3 = MT	36.7 = MT
Miscellaneous												
PERCHLORATE	MG/L					0.02 =	0.016 U	0.016 U	8 U	8 U	8 U	8 U
Pesticides												
DELTA BHC (DELTA HEXACHLOROCYCLOHEXAN	MG/L			0.000037	0.00001 U	0.00001 U	0.00001 U	0.00001 J	0.01 UJ	0.01 UJ	0.01 UJ	0.01 UJ
Semi-Volatiles												
DIETHYL PHTHALATE	MG/L			29.00	0.005 U	0.002 J	0.005 U	0.006 U	6 U	6 U		
bis(2-ETHYLHEXYL) PHTHALATE	MG/L			0.005	0.003 J	0.007 U	0.005 U	0.006 U	6 U	6 U		

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Table 3-2
Surface Soil Analytical Data Summary
SWMU-04, NASD - Vieques, PR

Parameter	Units	BKG	Industrial RBC (I)	Residential RBC RBC-R (R)	SSL (L)	SWMU4-MW05 NDB001 0 To 0.5 06/06/2000 10:50	SWMU4-MW06 NDB003 0 To 0.5 06/06/2000 11:15	SWMU4-MW07 NDB006 0 To 0.5 06/06/2000 13:30	SWMU4-MW08 NDB008 0 To 0.5 06/06/2000 10:00	W4-SB01 NDA057 0 To 0.5 04/18/2000 9:45	W4-SB02 NDA059 0 To 0.5 04/18/2000 10:10	W4-SB03 NDA061 0 To 0.5 04/18/2000 10:45	W4-SB04 NDA065 0 To 0.5 04/18/2000 14:00
Explosives													
2,6-DINITROTOLUENE	MG/KG			7.80	0.25	0.511 U	0.468 U	0.427 U	0.427 U	0.563 UJ	0.127 J	0.469 UJ	0.421 UJ
OCTAHYDRO-1,3,5,7-TETRANITRO-1,3,5,7-TETRAZOCINE	MG/KG			390.00		0.261 U	0.26 U	0.257 U	0.246 U	0.306 U	0.261 U	0.259 U	0.309 U
HEXAHYDRO-1,3,5-TRINITRO-1,3,5,7-TETRAZOCINE	MG/KG			5.80	0.01	0.261 U	0.26 U	0.257 U	0.246 U	0.306 U	0.261 U	0.259 U	0.309 U
2,4,6-TRINITROTOLUENE	MG/KG			21.00	0.06	0.261 U	0.26 U	0.257 U	0.246 U	0.306 U	0.261 U	0.259 U	0.309 U
Metals													
ALUMINUM	MG/KG		204400.00	7821.43		3350 =	2800 =	2640 =	3890 =	4580 J	4040 J	4920 J	**11700 = - R -**
ARSENIC	MG/KG	2.08	3.82	0.43	0.03	**0.83 J - R L**	**0.81 J - R L**	**0.57 J - R L**	**0.9 J - R L**	**0.88 J - R L**	**0.92 J - R L**	**0.8 J - R L**	**1.3 J - R L**
BARIUM	MG/KG	167.17	14308.00	547.50	2105.32	78.8 =	36.3 J	48.9 =	69.2 =	219 R	315 R	150 R	274 J
BERYLLIUM	MG/KG	0.58	408.80	15.64	1153.69	0.24 J	0.19 J	0.13 J	0.25 J	0.21 J	0.2 J	0.19 J	0.54 J
CADMIUM	MG/KG	0.35	102.20	3.91	27.45	0.028 J	0.021 U	0.021 U	0.022 J	0.032 J	0.32 J	0.021 U	0.025 U
CALCIUM	MG/KG					784 J	440 J	586 J	693 J	708 J	833 J	1020 J	1060 J
CHROMIUM, TOTAL	MG/KG	45.92	450.00	210.00	40.00	1.4 J	1.4 J	1.4 J	1.6 J	2.3 J	2.5 =	2.3 =	3.3 =
COBALT	MG/KG	39.41	12264.00	469.29		3.2 J	1.8 J	1.8 J	3 J	3.3 J	3.7 J	3.2 J	3.3 J
COPPER	MG/KG	147.78	8176.00	312.86	10517.84	6.2 =	2.1 J	2.9 J	10 =	10.7 =	38.4 =	7.3 =	1.9 J
IRON	MG/KG	9360.00	61320.00	2346.43		**6990 = - R -**	**5450 = - R -**	**4580 = - R -**	**7820 = - R -**	**6670 J - R -**	**7120 J - R -**	**6170 J - R -**	**16000 = - R -**
LEAD	MG/KG	4.19	100.00	40.00		10 =	4.9 =	5.2 =	8.2 =	12 J	20.1 J	11 J	8.2 =
MAGNESIUM	MG/KG					414 J	258 J	273 J	527 J	414 J	440 J	540 J	1040 J
MANGANESE	MG/KG	2516.77	4088.00	1600.00	950.00	399 =	417 =	285 =	311 =	337 R	345 R	382 R	188 =
MERCURY	MG/KG	0.04	61.32	2.35	2.10	0.013 U	0.013 U	0.0096 U	0.013 U	0.016 U	0.21 =	0.015 J	0.019 J
NICKEL	MG/KG	32.18	4088.00	156.43	100.00	0.38 J	0.4 J	0.37 J	0.53 J	0.48 J	0.48 J	0.63 J	0.88 J
POTASSIUM	MG/KG					442 J	419 J	464 J	440 J	236 J	233 J	310 J	291 J
SELENIUM	MG/KG	1.85	1022.00	39.11	18.98	0.53 J	0.65 J	0.34 J	0.65 J	0.26 U	0.23 U	0.22 U	0.6 J
SODIUM	MG/KG					106 J	118 J	83.7 J	127 J	98.9 J	104 J	135 J	402 J
THALLIUM	MG/KG		14.31	0.55	3.64	**0.68 J - R -**	**0.62 J - R -**	0.42 J	**0.89 J - R -**	0.34 U	0.29 U	0.43 J	**0.64 J - R -**
VANADIUM	MG/KG	169.89	1430.80	54.75	5111.02	23.9 =	19.9 =	18.8 =	23.4 =	29 J	29.9 J	21.3 J	43.7 =
ZINC	MG/KG	132.11	61320.00	2346.43	13621.80	13.8 =	5.1 =	4.7 =	16.7 =	14.1 =	93 =	12.8 =	9.9 =
Semi Volatile Organics													
1,3,5-TRINITROBENZENE	MG/KG					0.261 U	0.26 U	0.257 U	0.246 U	0.306 U	0.261 U	0.259 U	0.309 U
1,3-DINITROBENZENE	MG/KG					0.261 U	0.26 U	0.257 U	0.246 U	0.306 U	0.261 U	0.259 U	0.309 U
NITROBENZENE	MG/KG					0.511 U	0.468 U	0.427 U	0.427 U	0.563 UJ	0.465 UJ	0.469 UJ	0.421 UJ
2,6-DINITROTOLUENE	MG/KG			7.80	0.25	0.511 U	0.468 U	0.427 U	0.427 U	0.563 UJ	0.127 J	0.469 UJ	0.421 UJ
2,4-DINITROTOLUENE	MG/KG			16.00	0.57	0.511 U	0.468 U	0.427 U	0.427 U	0.563 UJ	**1.98 J - - L**	0.469 UJ	0.421 UJ
DIETHYL PHTHALATE	MG/KG			6300.00	450.00	0.511 U	0.468 U	0.427 U	0.427 U	0.563 UJ	0.465 UJ	0.091 J	0.038 J
N-NITROSODIPHENYLAMINE	MG/KG			13.00	0.76	0.511 U	0.468 U	0.427 U	0.427 U	0.563 UJ	0.17 J	0.469 UJ	0.421 UJ
DI-n-BUTYL PHTHALATE	MG/KG			780.00	5000.00	0.511 U	0.468 U	0.427 U	0.427 U	0.563 UJ	0.028 J	0.469 UJ	0.421 UJ
bis(2-ETHYLHEXYL) PHTHALATE	MG/KG			46.00	2900.00	0.511 U	0.468 U	0.427 U	0.427 U	0.563 UJ	0.041 J	0.469 UJ	0.421 UJ
Volatile Organics													
ACETONE	MG/KG			780.00	2.50	0.033 =	0.05 =	0.025 =	0.229 E	0.062 J	0.663 R	0.033 J	0.718 R
TOLUENE	MG/KG		40880.00	1564.29	8.79	0.012 U	0.011 U	0.012 U	0.01 U	0.0004 J	0.011 U	0.012 U	0.012 U
O-XYLENE (1,2-DIMETHYLBENZENE)	MG/KG		408800.00	15642.86	229.95	0.012 U	0.011 U	0.012 U	0.01 U	0.0003 J	0.011 U	0.012 U	0.012 U

The risk-based concentrations are based on a hazard quotient (HQ) of 0.1 and an excess lifetime cancer risk of 10 -6.
BKG = background (2 times average) values from AFWTF Camp Garcia Western Perimeter Study (November 1999)
Industrial RBC = EPA Region III Risk Based Concentration for Soil (Industrial)
Residential RBC = EPA Region III Risk Based Concentration for Soil (Residential)
SSL = EPA Region III Soil Screening Level for Groundwater Migration (with a dilution factor (DAF) of 20

Table 3-2
Surface Soil Analytical Data Summary
SWMU-04, NASD - Vieques, PR

StationID						W4-SB05	W4-SB06	W4-SB07	W4-SB08	W4-SB09	W4-SB10	W4-SB11	W4-SB12
SampleID						NDA067	NDA069	NDA071	NDA074	NDA076	NDA078	NDA080	NDA082
Collection Depth			Industrial	Residential		0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5
Date Collected			RBC	RBC	SSL	04/18/2000 14:55	04/18/2000 15:30	04/19/2000 9:00	04/19/2000 9:20	04/19/2000 9:50	04/19/2000 10:20	04/19/2000 11:10	04/19/2000 13:10
Parameter	Units	BKG	(I)	RBC-R (R)	(L)								
Explosives													
2,6-DINITROTOLUENE	MG/KG			7.80	0.25	0.378 UJ	0.32 UJ	0.554 UJ	0.448 UJ	0.419 UJ	0.44 UJ	0.407 UJ	4.66 UJ
OCTAHYDRO-1,3,5,7-TETRANITRO-1,3,5,7-TETRAZOCINE	MG/KG			390.00		0.268 UJ	0.255 UJ	0.292 U	0.262 U	0.259 U	2.15 =	0.254 U	0.125 UJ
HEXAHYDRO-1,3,5-TRINITRO-1,3,5,7-TETRAZOCINE	MG/KG			5.80	0.01	0.268 UJ	0.255 UJ	0.292 U	0.262 U	0.259 U	12.8 = - R L	0.254 U	0.125 UJ
2,4,6-TRINITROTOLUENE	MG/KG			21.00	0.06	0.268 UJ	0.255 UJ	0.292 U	0.262 U	0.259 U	5.57 = - - L	0.254 U	0.125 UJ
Metals													
ALUMINUM	MG/KG		204400.00	7821.43		8480 = - R -	5340 =	5080 =	4840 =	7600 =	4300 =	1960 =	1820 =
ARSENIC	MG/KG	2.08	3.82	0.43	0.03	0.64 J - R L	0.98 J - R L	0.81 J - R L	1.2 J - R L	0.67 J - R L	0.6 J - R L	0.36 U	0.36 J - - L
BARIUM	MG/KG	167.17	14308.00	547.50	2105.32	66.2 J	168 J	204 =	313 =	276 =	226 =	81.8 =	56 =
BERYLLIUM	MG/KG	0.58	408.80	15.64	1153.69	0.3 J	0.36 J	0.27 J	0.34 J	0.43 J	0.29 J	0.13 J	0.14 J
CADMIUM	MG/KG	0.35	102.20	3.91	27.45	0.022 U	0.021 U	0.024 U	0.021 U	0.021 U	0.021 U	0.021 U	0.02 U
CALCIUM	MG/KG					906 J	958 J	828 J	3470 =	4890 =	1010 J	1030 J	879 J
CHROMIUM, TOTAL	MG/KG	45.92	450.00	210.00	40.00	3.2 =	2.7 =	2.4 J	2.2 =	5.6 =	4.7 =	2.2 =	2 J
COBALT	MG/KG	39.41	12264.00	469.29		1.3 J	4.9 J	2.5 J	2.7 J	5.9 J	3.5 J	3.4 J	2.5 J
COPPER	MG/KG	147.78	8176.00	312.86	10517.84	2.2 J	16.5 =	8.9 =	6 =	7.9 =	11.9 =	5.5 =	5 J
IRON	MG/KG	9360.00	61320.00	2346.43		8800 = - R -	9320 = - R -	8330 = - R -	9370 = - R -	15700 = - R -	8820 = - R -	8950 = - R -	8240 = - R -
LEAD	MG/KG	4.19	100.00	40.00		6.3 =	75.4 = - R -	8.6 =	5.2 =	8.5 =	7 =	4 =	4.4 =
MAGNESIUM	MG/KG					929 J	529 J	848 J	1660 =	2150 =	953 J	454 J	438 J
MANGANESE	MG/KG	2516.77	4088.00	1600.00	950.00	39.9 =	537 =	264 =	171 =	692 =	207 =	435 =	273 =
MERCURY	MG/KG	0.04	61.32	2.35	2.10	0.013 U	0.015 J	0.014 U	0.011 U	0.012 U	0.013 U	0.012 U	0.012 U
NICKEL	MG/KG	32.18	4088.00	156.43	100.00	0.79 J	0.74 J	0.61 J	0.94 J	2.2 J	0.9 J	0.77 J	0.62 J
POTASSIUM	MG/KG					257 J	325 J	243 J	262 J	403 J	282 J	350 J	312 J
SELENIUM	MG/KG	1.85	1022.00	39.11	18.98	0.23 U	0.41 J	0.25 U	0.22 U	0.22 U	0.22 U	0.22 U	0.21 U
SODIUM	MG/KG					418 J	127 J	870 J	785 J	1220 J	1170 J	51.3 J	54.5 J
THALLIUM	MG/KG		14.31	0.55	3.64	0.29 U	0.46 J	0.59 J - R -	0.29 U	0.72 J - R -	0.46 J	0.53 J	0.31 J
VANADIUM	MG/KG	169.89	1430.80	54.75	5111.02	30.9 =	38 =	29.2 =	29.6 =	55.1 = - R -	30.6 =	30 =	28.9 =
ZINC	MG/KG	132.11	61320.00	2346.43	13621.80	7.8 =	22.4 =	12.5 =	17.9 =	19.6 =	17.9 =	8.6 =	9.6 =
Semi Volatile Organics													
1,3,5-TRINITROBENZENE	MG/KG					0.268 UJ	0.255 UJ	0.292 U	0.262 U	0.259 U	0.133 U	0.254 U	0.125 UJ
1,3-DINITROBENZENE	MG/KG					0.268 UJ	0.255 UJ	0.292 U	0.262 U	0.259 U	0.133 U	0.254 U	0.125 UJ
NITROBENZENE	MG/KG					0.378 UJ	0.32 UJ	0.554 UJ	0.448 UJ	0.419 UJ	0.44 UJ	0.407 UJ	4.66 UJ
2,6-DINITROTOLUENE	MG/KG			7.80	0.25	0.378 UJ	0.32 UJ	0.554 UJ	0.448 UJ	0.419 UJ	0.44 UJ	0.407 UJ	4.66 UJ
2,4-DINITROTOLUENE	MG/KG			16.00	0.57	0.378 UJ	0.32 UJ	0.554 UJ	0.448 UJ	0.419 UJ	0.44 UJ	0.407 UJ	4.66 UJ
DIETHYL PHTHALATE	MG/KG			6300.00	450.00	0.378 UJ	0.32 UJ	0.554 UJ	0.448 UJ	0.419 UJ	0.44 UJ	0.407 UJ	4.66 UJ
N-NITROSODIPHENYLAMINE	MG/KG			13.00	0.76	0.378 UJ	0.32 UJ	0.554 UJ	0.448 UJ	0.419 UJ	0.44 UJ	0.407 UJ	4.66 UJ
DI-n-BUTYL PHTHALATE	MG/KG			780.00	5000.00	0.378 UJ	0.32 UJ	0.554 UJ	0.448 UJ	0.419 UJ	0.44 UJ	0.407 UJ	4.66 UJ
bis(2-ETHYLHEXYL) PHTHALATE	MG/KG			46.00	2900.00	0.378 UJ	0.32 UJ	0.554 UJ	0.448 UJ	0.419 UJ	0.44 UJ	0.407 UJ	4.66 UJ
Volatile Organics													
ACETONE	MG/KG			780.00	2.50	0.015 R	0.362 R	0.012 U	0.06 R	0.01 R	0.014 R	0.01 R	0.013 R
TOLUENE	MG/KG		40880.00	1564.29	8.79	0.012 U	0.011 U	0.012 U	0.01 U	0.01 U	0.011 U	0.01 U	0.013 U
O-XYLENE (1,2-DIMETHYLBENZENE)	MG/KG		408800.00	15642.86	229.95	0.012 U	0.011 U	0.012 U	0.01 U	0.01 U	0.011 U	0.01 U	0.013 U

The risk-based concentrations are based on a hazard quotient (HQ) of 0.1 and an excess lifetime c
BKG = background (2 times average) values from AFWTF Camp Garcia Western Perimeter Study (N
Industrial RBC = EPA Region III Risk Based Concentration for Soil (Industrial)
Residential RBC = EPA Region III Risk Based Concentration for Soil (Residential)
SSL = EPA Region III Soil Screening Level for Groundwater Migration (with a dilution factor (DAF) of 2

Table 3-3
Subsurface Soil Analytical Data Summary
SWMU 4, NASD - Vieques, PR

	StationID			SWMU4-MW05	SWMU4-MW06	SWMU4-MW07	SWMU4-MW08	W4-SB01	W4-SB02	W4-SB03	W4-SB04	W4-SB05	W4-SB06	W4-SB07	W4-SB08	W4-SB09	W4-SB10	W4-SB11	W4-SB12
	SampleID			NDB002	NDB005	NDB007	NDB009	NDA058	NDA060	NDA063	NDA066	NDA068	NDA070	NDA073	NDA075	NDA077	NDA079	NDA081	NDA083
	Collection Depth			4 To 6	4 To 6	4 To 6	4 To 6	4 To 6	4 To 6	4 To 6	4 To 6	4 To 6	4 To 6	4 To 6	4 To 6	4 To 6	4 To 6	4 To 6	4 To 6
	Date Collected	Screening Criteria		06/06/2000 11:00	06/06/2000 13:45	06/06/2000 14:45	06/06/2000 10:40	04/18/2000 10:40	04/18/2000 13:30	04/18/2000 14:15	04/18/2000 15:30	04/18/2000 15:50	04/19/2000 10:30	04/19/2000 13:00	04/19/2000 13:30	04/19/2000 14:15	04/19/2000 14:30	04/19/2000 15:20	04/19/2000 15:45
Parameter Name	Units	BKG	SSL (L)																
Metals																			
ALUMINUM	MG/KG			3510 =	2030 =	2440 =	3140 =	7470 J	4610 J	7700 =	7150 =	11500 =	7760 =	3050 =	5850 =	5110 =	8500 =	6020 =	2080 =
ARSENIC	MG/KG	2.08	0.03	1.2 J -	0.75 J -	0.83 J -	0.97 J -	0.66 J -	0.62 J -	1.8 J -	1.1 J -	2.3 = -	0.83 J -	0.58 J -	1.2 J -	0.88 J -	0.85 J -	0.36 U	0.35 U
BARIUM	MG/KG	167.17	2105.32	364 =	78.6 =	101 =	87.5 =	702 R	177 R	504 J	103 J	3170 J -	892 R	108 =	247 =	387 =	164 =	219 =	104 =
BERYLLIUM	MG/KG	0.58	1153.69	0.29 J	0.26 J	0.26 J	0.2 J	0.37 J	0.27 J	0.6 J	0.47 J	1.3 =	0.38 J	0.66 J	0.43 J	0.38 J	0.55 J	0.26 J	0.16 J
CALCIUM	MG/KG			976 J	470 J	961 J	1120 J	821 J	668 J	1310 =	1000 J	2970 =	37000 =	611 J	2540 =	2050 =	8790 =	894 J	1090 =
CHROMIUM, TOTAL	MG/KG	45.92	40.00	19 =	3.6 =	2 J	5.8 =	7 =	9.7 =	10 =	4.5 =	3.7 =	7.8 =	3 =	6.4 =	3.7 =	5.7 =	14.7 =	1.9 J
COBALT	MG/KG	39.41		6.1 J	2.1 J	1.9 J	3.7 J	3.6 J	4.4 J	5.5 J	3.8 J	2.5 J	3.7 J	6 J	4.3 J	7.1 J	8 J	2.4 J	3 J
COPPER	MG/KG	147.78	10517.84	7.9 =	2.7 J	5.7 =	11.3 =	5.2 J	8.1 =	10 =	3.1 J	4.7 J	9.7 =	4 J	6.8 =	7.7 =	7.2 =	2.3 J	3.4 J
IRON	MG/KG	9360.00		7700 =	6170 =	4920 =	6790 =	8390 J	5530 J	16000 =	10400 =	14200 =	10400 =	10000 =	13900 =	12000 =	22700 =	4470 =	6530 =
LEAD	MG/KG	4.19		11.9 =	4.2 =	4 =	8.6 =	7.8 J	10 J	21.1 =	7.2 =	7.7 =	20.7 =	4.8 =	7.7 =	9 =	7.5 =	5.6 =	4.6 =
MAGNESIUM	MG/KG			957 J	806 J	938 J	670 J	983 J	673 J	1340 =	1000 J	4620 =	2660 =	1160 =	2950 =	1330 =	2380 =	538 J	382 J
MANGANESE	MG/KG	2516.77	950.00	696 =	362 =	412 =	367 =	956 R	703 R	742 =	280 =	574 =	477 =	447 =	460 =	906 =	761 =	169 =	321 =
NICKEL	MG/KG	32.18	100.00	7.1 J	0.49 J	0.54 J	1.3 J	2.5 J	3.6 J	1.8 J	1.1 J	1.8 J	4.4 J	0.89 J	2.3 J	2.2 J	2 J	2 J	0.47 J
POTASSIUM	MG/KG			479 J	407 J	433 J	566 J	321 J	231 J	357 J	238 J	373 J	433 J	293 J	290 J	340 J	262 J	198 J	263 J
SELENIUM	MG/KG	1.85	18.98	0.41 J	0.22 U	0.33 J	0.38 J	0.26 J	0.23 U	0.23 U	0.22 U	0.23 U	0.22 U	0.29 J	0.22 U	0.25 U	0.24 U	0.22 U	0.22 U
SODIUM	MG/KG			416 J	655 J	590 J	226 J	1220 =	740 J	1510 J	448 J	3730 J	1370 J	912 J	1420 J	653 J	1960 J	453 J	93.6 J
THALLIUM	MG/KG		3.64	0.76 J	0.55 J	0.45 J	0.33 U	0.3 U	0.3 U	0.97 J	0.51 J	0.64 J	0.29 U	0.31 J	0.64 J	0.77 J	1.1 J	0.29 U	0.33 J
VANADIUM	MG/KG	169.89	5111.02	31.6 =	19.4 =	14.7 =	19 =	35.5 J	23.2 J	71.9 =	31.5 =	35 =	37.1 =	31.3 =	33.8 =	47.2 =	87.9 =	17.7 =	25.1 =
ZINC	MG/KG	132.11	13621.80	15 =	13.6 =	15.1 =	19 =	9.6 =	14.7 =	14.8 =	13 =	26.1 =	20.6 =	14.9 =	24.5 =	15.8 =	13.6 =	8.1 =	6.6 =
Semi-Volatiles																			
BENZYL BUTYL PHTHALATE	MG/KG		17000.00	0.468 U	0.467 U	0.407 U	0.056 J	0.46 UJ	0.478 UJ	0.382 UJ	0.344 UJ	0.36 UJ	0.404 UJ	0.383 UJ	0.401 UJ	0.441 UJ	0.466 UJ	0.393 UJ	4.24 UJ
bis(2-ETHYLHEXYL) PHTHALATE	MG/KG		2900.00	0.468 U	0.467 U	0.407 U	0.527 U	0.46 UJ	0.478 UJ	0.382 UJ	0.344 UJ	0.36 UJ	0.101 J	0.383 UJ	0.401 UJ	0.441 UJ	0.466 UJ	0.393 UJ	4.24 UJ
Volatiles																			
ACETONE	MG/KG		2.50	0.123 =	0.055 =	0.048 =	0.017 =	0.011 R	0.03 R	0.022 R	0.551 R	0.026 R	0.016 R	0.012 R	0.013 R	0.018 R	0.011 R	0.01 R	0.012 R
METHYL ETHYL KETONE (2-BUTANONE)	MG/KG		7.90	0.006 J	0.003 J	0.011 U	0.011 U	0.01 R	0.003 J	0.011 R	0.01 R	0.011 R	0.01 R	0.01 R	0.01 R	0.01 R	0.01 R	0.01 R	0.01 R
BENZENE	MG/KG		0.002	0.01 U	0.0001 U	0.011 U	0.0002 J	0.01 UJ	0.01 U	0.011 UJ	0.01 UJ	0.011 U	0.01 UJ	0.01 U	0.01 U	0.01 U	0.01 U	0.01 UJ	0.0001 U
METHYL ISOBUTYL KETONE	MG/KG			0.01 U	0.002 J	0.011 U	0.011 U	0.01 UJ	0.01 U	0.011 UJ	0.01 UJ	0.011 U	0.01 UJ	0.01 U	0.01 U	0.01 U	0.01 U	0.01 UJ	0.01 U
M,P-XYLENE (SUM OF ISOMERS)	MG/KG		170.00	0.01 U	0.0003 J	0.011 U	0.011 U	0.01 UJ	0.01 U	0.011 UJ	0.01 UJ	0.011 U	0.01 UJ	0.01 U	0.01 U	0.01 U	0.01 U	0.01 UJ	0.01 U
STYRENE	MG/KG		57.00	0.01 U	0.011 U	0.011 U	0.011 U	0.01 UJ	0.01 U	0.011 UJ	0.0006 J	0.011 U	0.01 UJ	0.01 U	0.01 U	0.01 U	0.01 U	0.01 UJ	0.01 U
XYLENES, TOTAL	MG/KG		170.19	0.01 U	0.0003 J	0.011 U	0.011 U	0.01 UJ	0.01 U	0.011 UJ	0.01 UJ	0.011 U	0.01 UJ	0.01 U	0.01 U	0.01 U	0.01 U	0.01 UJ	0.01 U

The risk-based concentrations are based on a hazard quotient (HQ) of 0.1 and an excess lifetime cancer risk of 10 -6.
BKG = background (2 times average) values from AFWTF Camp Garcia Western Perimeter Study (November 1999)
SSL = EPA Region III Soil Screening Level for Groundwater Migration (with a dilution factor (DAF) of 20

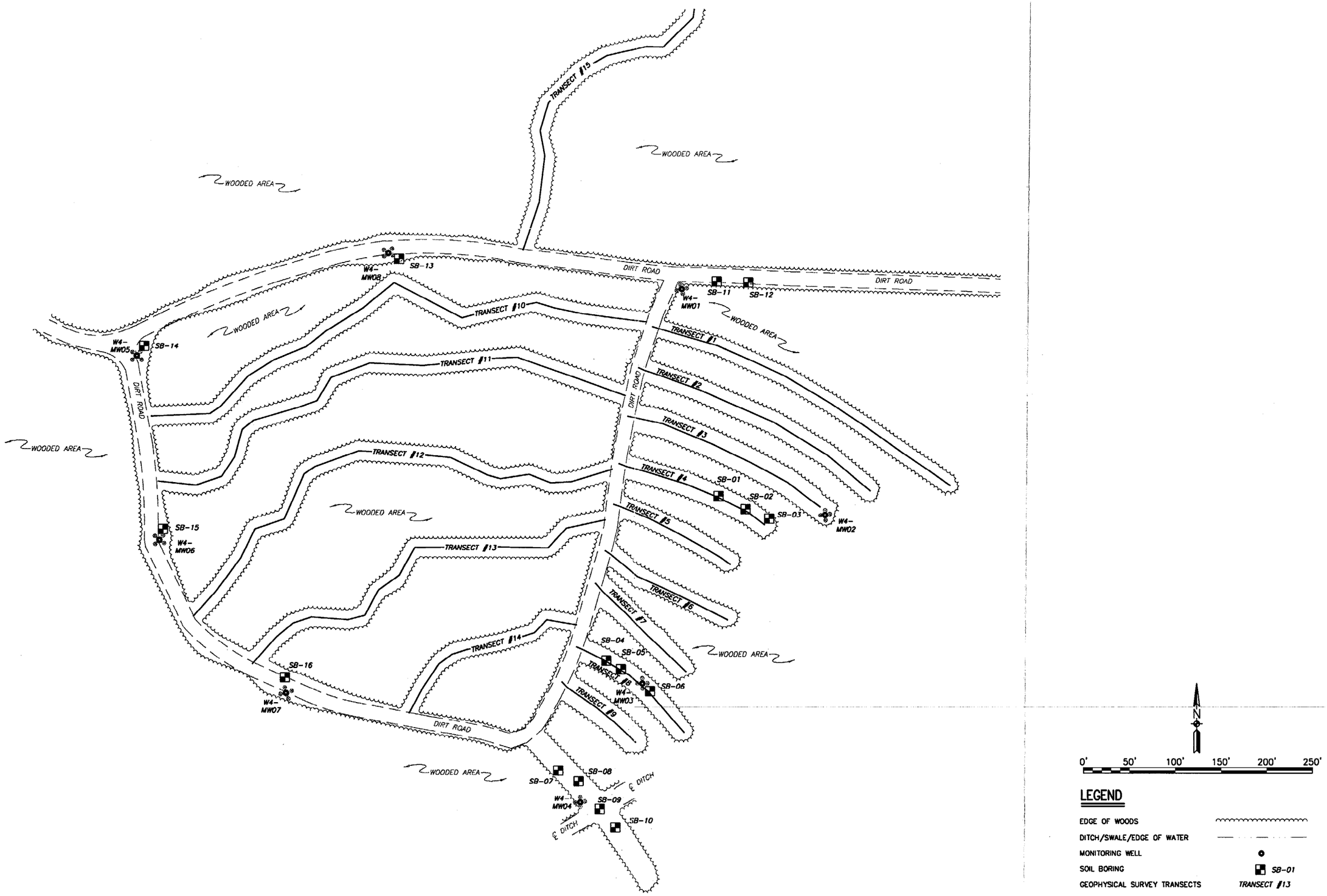

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Figure 3-1 SWMU-04
Sample Locations
Naval Ammunition Support Detachment, Vieques Island

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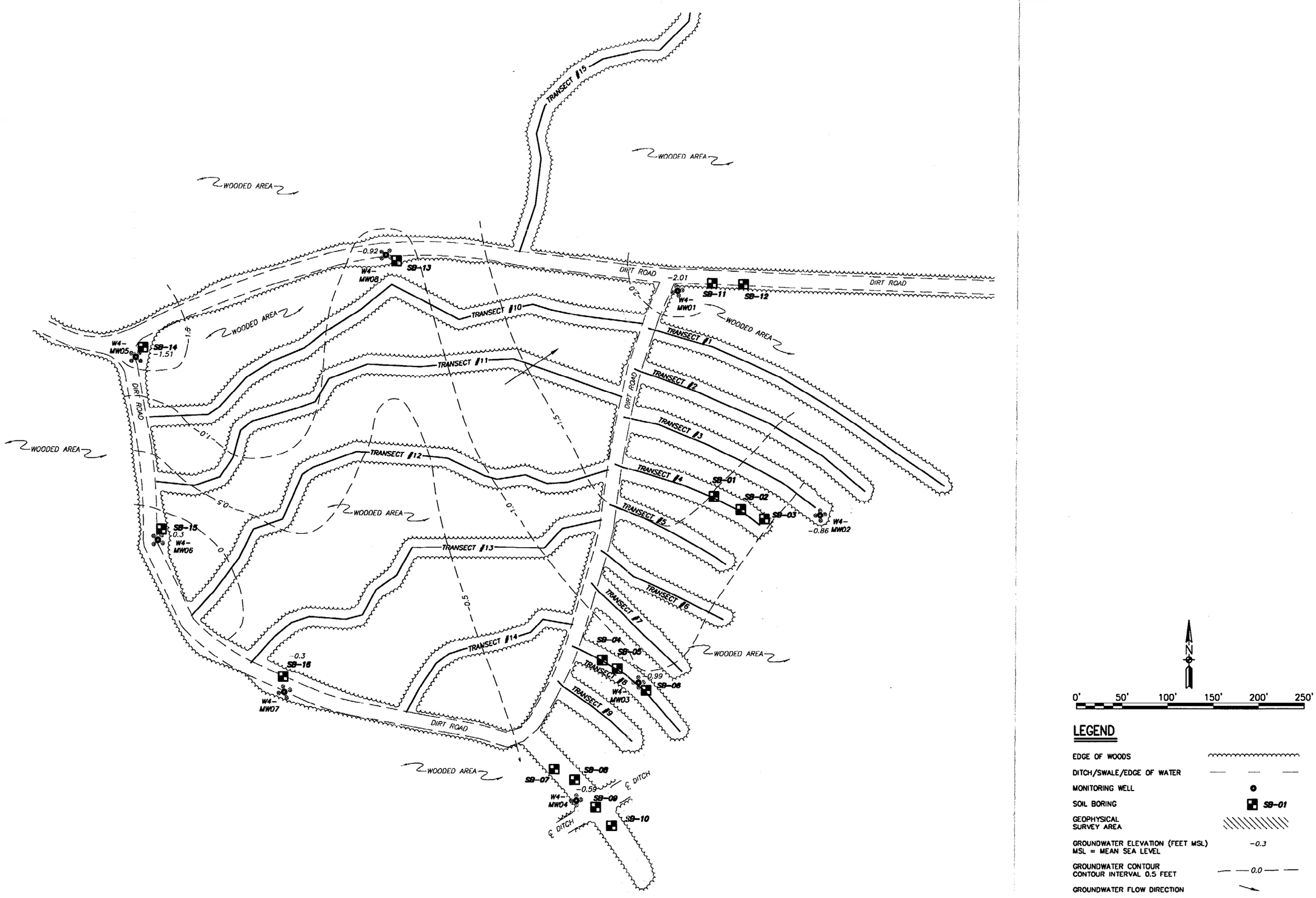

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Figure 3-2 SWMU-04
Groundwater Flow
Naval Ammunition Support Detachment, Vieques Island

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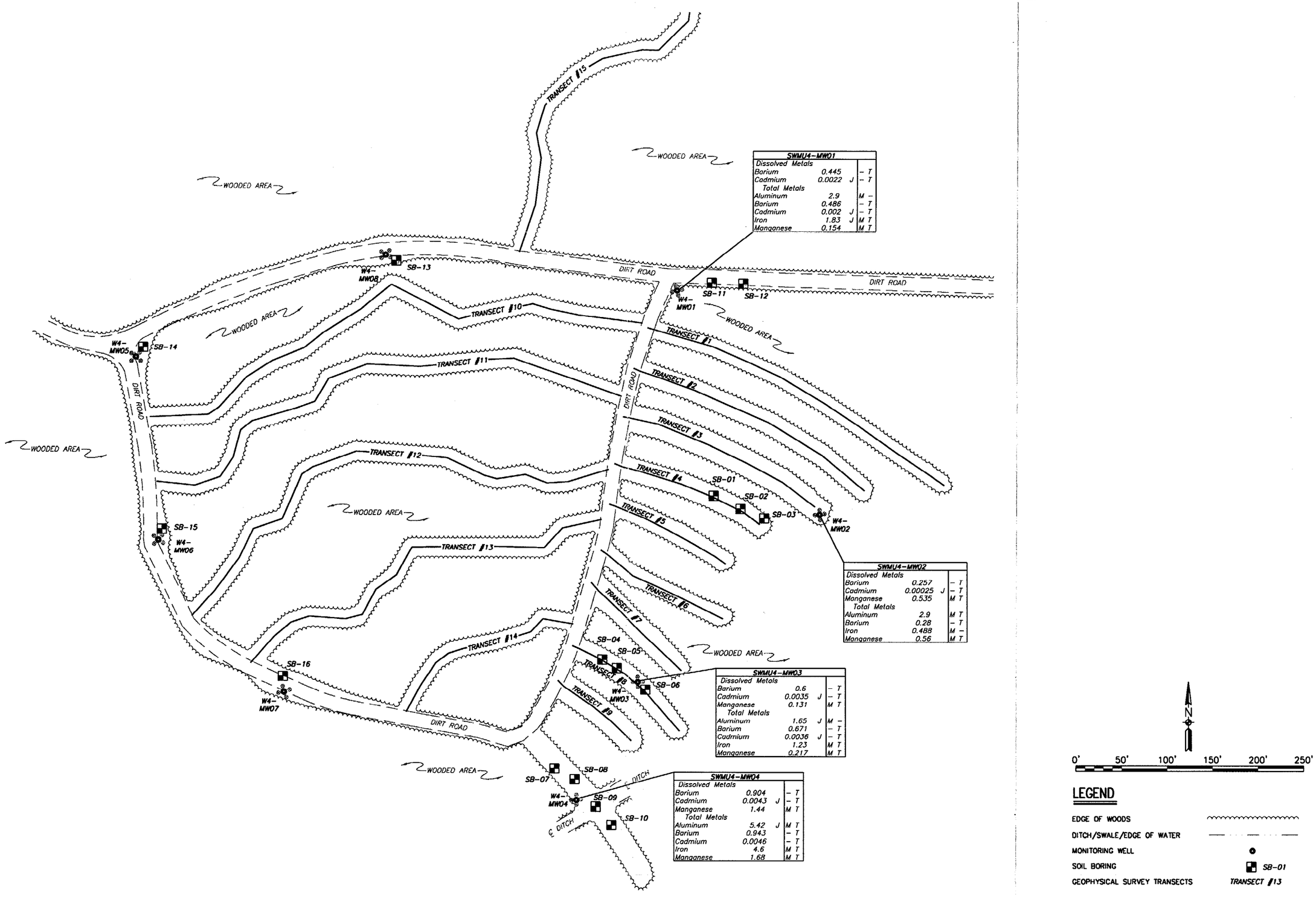

SWMU4-MW01			
Dissolved Metals			
Barium	0.445		– T
Cadmium	0.0022	J	– T
Total Metals			
Aluminum	2.9		M –
Barium	0.486		– T
Cadmium	0.002	J	– T
Iron	1.83	J	M T
Manganese	0.154		M T

SWMU4-MW02			
Dissolved Metals			
Barium	0.257		– T
Cadmium	0.00025	J	– T
Manganese	0.535		M T
Total Metals			
Aluminum	2.9		M T
Barium	0.28		– T
Iron	0.488		M –
Manganese	0.56		M T

SWMU4-MW03			
Dissolved Metals			
Barium	0.6		– T
Cadmium	0.0035	J	– T
Manganese	0.131		M T
Total Metals			
Aluminum	1.65	J	M –
Barium	0.671		– T
Cadmium	0.0036	J	– T
Iron	1.23		M T
Manganese	0.217		M T

SWMU4-MW04			
Dissolved Metals			
Barium	0.904		– T
Cadmium	0.0043	J	– T
Manganese	1.44		M T
Total Metals			
Aluminum	5.42	J	M T
Barium	0.943		– T
Cadmium	0.0046		– T
Iron	4.6		M T
Manganese	1.68		M T

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Figure 3-3 SWMU-04
Groundwater Detections Above Screening Criteria
Naval Ammunition Support Detachment, Vieques Island

CH2MHILL

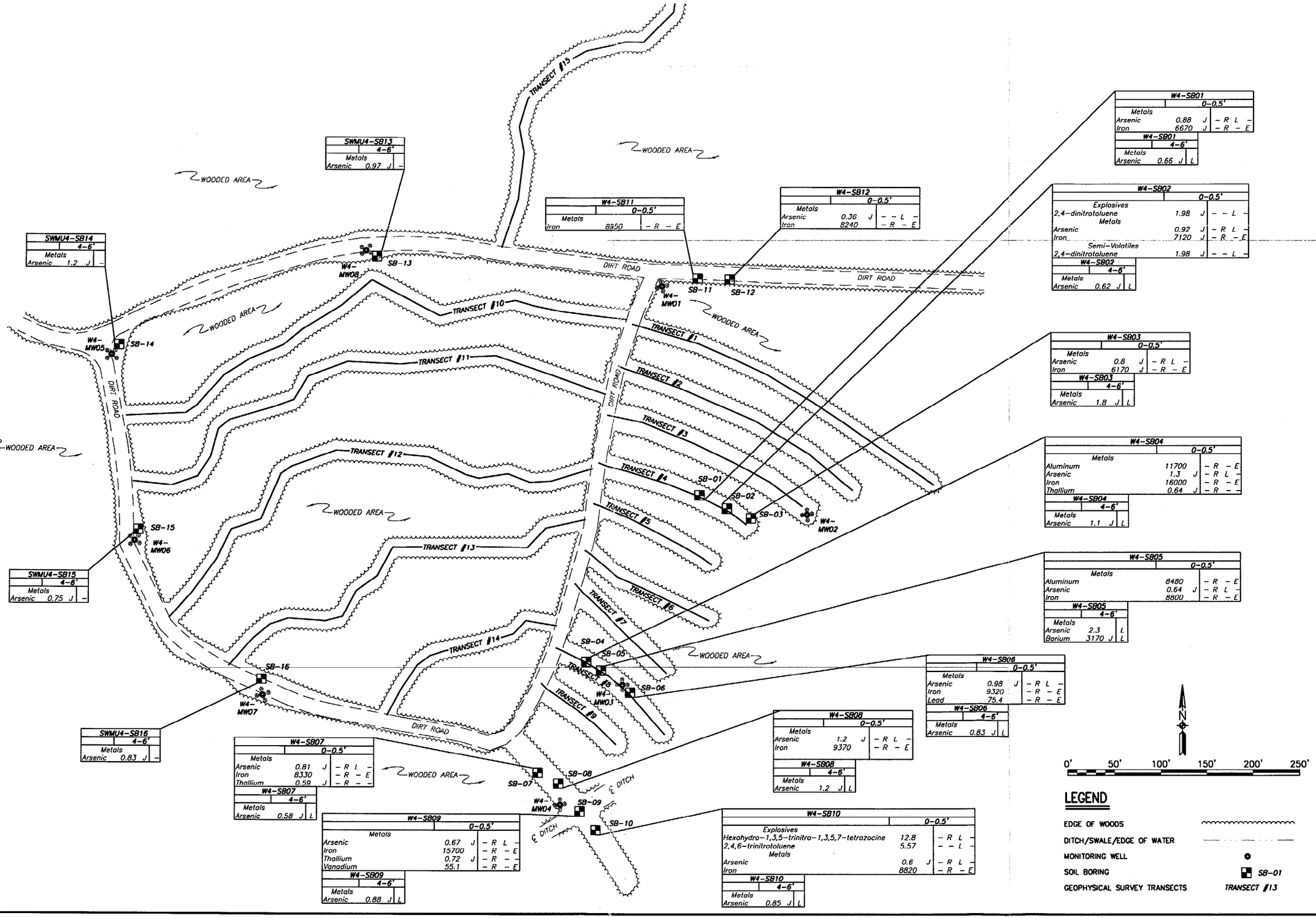

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Figure 3-4 SWMU-04
Soil Detections Above Screening Criteria
Naval Ammunition Support Detachment, Vieques Island

CH2MHILL

SECTION 4

SWMU 05 IRFNA/MAF-4 Disposal Site

This section presents the results of the Expanded PA/SI investigation performed at SWMU 05 –IRFNA/MAF-4 Disposal Site at NASD, Vieques, Puerto Rico. The field sampling activities associated with this investigation were performed by CH2M HILL in April 2000.

This section includes a description of the objectives of the Expanded PA/SI, a site description, results of previous investigations, summary of field activities, summary of laboratory results, and conclusions and recommendations. To evaluate the potential for environmental impacts from the site, data were compared to applicable regulatory screening and preliminary background values. A description of the environmental screening process was presented in Section 2.14 of this report

4.1 Objectives

The specific objectives of this investigation were to:

1. Determine if a release of hazardous materials has occurred as a result of site-related activities; and
2. Asses whether the site is a candidate for closeout as a NFRAP site, or
3. Determine if further investigation or evaluation are warranted at this SWMU.

4.2 Site Description

This inactive unit is the site where, in 1975, approximately 7,000 pounds of fuel was emptied from leaking drones into a low spot in a road near Building 422. The IAS Report (1984) states that the Quebrada where the disposal took place is in the probable surface recharge area for one of the few naturally occurring springs on the island that flows year-round. The site is less than 2 miles from Cattle Cooperative Well 3PW01 and a spring, both of which were used by the local cattle cooperative until 1992.

The fuel contained 5,275 pounds of inhibited red fuming nitric acid (IRFNA) and 1,775 pounds of mixed amine fuels (MAF-4) which were emptied into the Quebrada. Although much of the material has likely volatized volatilized or biodegraded, site investigations were conducted during the PA/SI to evaluate the potential presence of nitrogen-containing chemicals in the soil.

4.2.1 Summary of Qualitative Ecological Survey

The plant community present within and adjacent to the small drainage ditch consists of well-maintained grass. A large ravine (quebrada) is present to the west of the ditch. The small drainage ditch is located within the area where regular grounds maintenance occurs around Magazine Building 422. A regular disturbance by mowing has created a low-growing herbaceous community. Dominant grasses within this drainage ditch include *Bothriochloa ischaemum, Sporobolus indicus, Cynodon dactylon,* and *Scleria* sp. No endangered or threatened plant species were observed during the field survey.

The large ravine adjacent to the site consists of a patchy canopy of various trees, shrubs, and herbaceous ground cover. *Eriochloa polystachya, Leonotis nepetifolia, Panicum maximum,* and *Commelina erecta* dominated the herbaceous stratum. Shrubs are found mostly along the hillside edges; these include *Randia aculeata, Erythroxylum brevipes, Acacia farnenciana,* and *Leucaena leucocephala.* There were a few trees (*Bursera simaruba* and *Tamarindus indica*) present throughout the area.

During the wildlife surveys conducted on this site, a few wildlife species were observed utilizing the habitat in this area. No endangered or threatened wildlife species were observed during the survey. Although no horses were observed, there was sufficient evidence to indicate that they frequent this habitat. Other wildlife species included mongoose, anole, bananaquit, white-crowned dove, adelaidae warbler, puerto rican lizard cuckoo, gray kingbird, and zenaida dove. There was no evidence that the SWMU site has had an impact on wildlife or its habitat. Two dead animals were found near the site. One of the remains was a skeleton of a bovine species that died some time ago and the other was a horse which appeared to have died more recently (less than five days old). The cause of mortality of these animals is unknown, but they probably died due to natural causes and their presence was most likely coincidental.

4.3 Previous Investigations

In April 1988, Environmental Science and Engineering, Inc. (ESE) prepared a Confirmation Study to determine possible dispersion and migration of specific chemicals at NSRR and NASD, Vieques Islands, for the Atlantic Division, Naval Facilities Engineering Command. The objective of this confirmation study was to determine whether specific toxic or hazardous materials have contaminated the environment as a result of Navy activities. During this investigation, one nearby spring was sampled for pH and Priority Pollutants. Zinc was the only constituent detected from this sampling, with a concentration of 0.469 milligrams per liter (mg/L). No soil borings were installed at this site location.

4.4 Expanded PA/SI Field Investigations

The Expanded PA/SI for SWMU 05 was conducted in April 2000. The field investigation included collection of surface soil and subsurface soil samples from four borings. Figure 4-1 is a site map of SWMU 05 with the soil sampling locations.

4.4.1 Soil Sampling

CH2M HILL installed four soil borings to depths of 6 to 21 feet along the ditch, as shown in Figure 4-1. The samples were screened in the field using an OVM and submitted to the laboratory for analysis. Samples were analyzed for VOCs, SVOCs, and explosives.

4.5 Field Screening Results

Soil samples were screened in the field for VOCs using an OVM. This field screening method provides a qualitative evaluation of potential organic constituents in soil. The OVM results for the site are summarized in Appendix B. The results indicate that OVM readings ranged from –0.1 to 9.5 ppm.

4.6 Laboratory Results

The following section presents the interpretation of the analytical data from the SWMU 05 Expanded PA/SI investigation. The discussion includes the identification of screening/regulatory criteria exceedances, as well as exceedances of preliminary

background for the individual media sampled. Conclusions and recommendations, by media, are presented in Section 4.7.

Concentrations of chemicals detected in soil were compared to current USEPA residential and industrial RBCs and soil screening level criteria. Background criteria were obtained from data collected from Camp Garcia (Baker Environmental, Inc., November 1999).

Appendix I contains a compilation of the concentrations for all chemicals for which samples were analyzed. Appendix J contains a data validation summary.

4.6.1 Surface Soil Results

Analytical results indicate a single detection of benzo(a)pyrene at levels slightly above the residential RBC. Benzo(a)pyrene was detected in SWMU04-SB01 at a concentration of 0.088 mg/L, which is close to the residential RBC of 0.087 mg/L. This constituent is a potential byproduct that may be derived from the asphalt pavement located adjacent to the sampling site.

VOCs, SVOCs, pesticides, PCBs, and explosives were either not detected, or were detected at concentrations below their applicable screening criteria. Table 4-1 summarizes the surface soil detections, which are presented graphically on Figure 4-2.

4.6.2 Subsurface Soil Results

No constituents were detected above screening criteria in subsurface soils.

4.7 Conclusions and Recommendations

This section summarizes the results of the Expanded PA/SI activities by media, and provides recommendations for each media sampled. The data indicate that the lone constituent detected in surface soil was the result of asphalt runoff rather than a release of hazardous material or disposal of fuel.

However, it is recommended that a Preliminary Risk Evaluation (PRE) be conducted to calculate the potential risk to human health presented by benzo(a)pyrene in surface soil at the site.

4.7.1 Surface Soil

Benzo(a)pyrene was the only constituent detected above screening criteria. However, the detected concentration of 0.088 mg/L is similar to the residential RBC of 0.087 mg/L. This single detection is likely the result of asphalt runoff, rather than the disposal of fuel containing IRFNA and MAF-4.

No evidence exists to suggest that a release of hazardous materials to surface soil has occurred as a result of disposal of fuel containing IRFNA and MAF-4. As a result, no additional surface soil sampling is recommended.

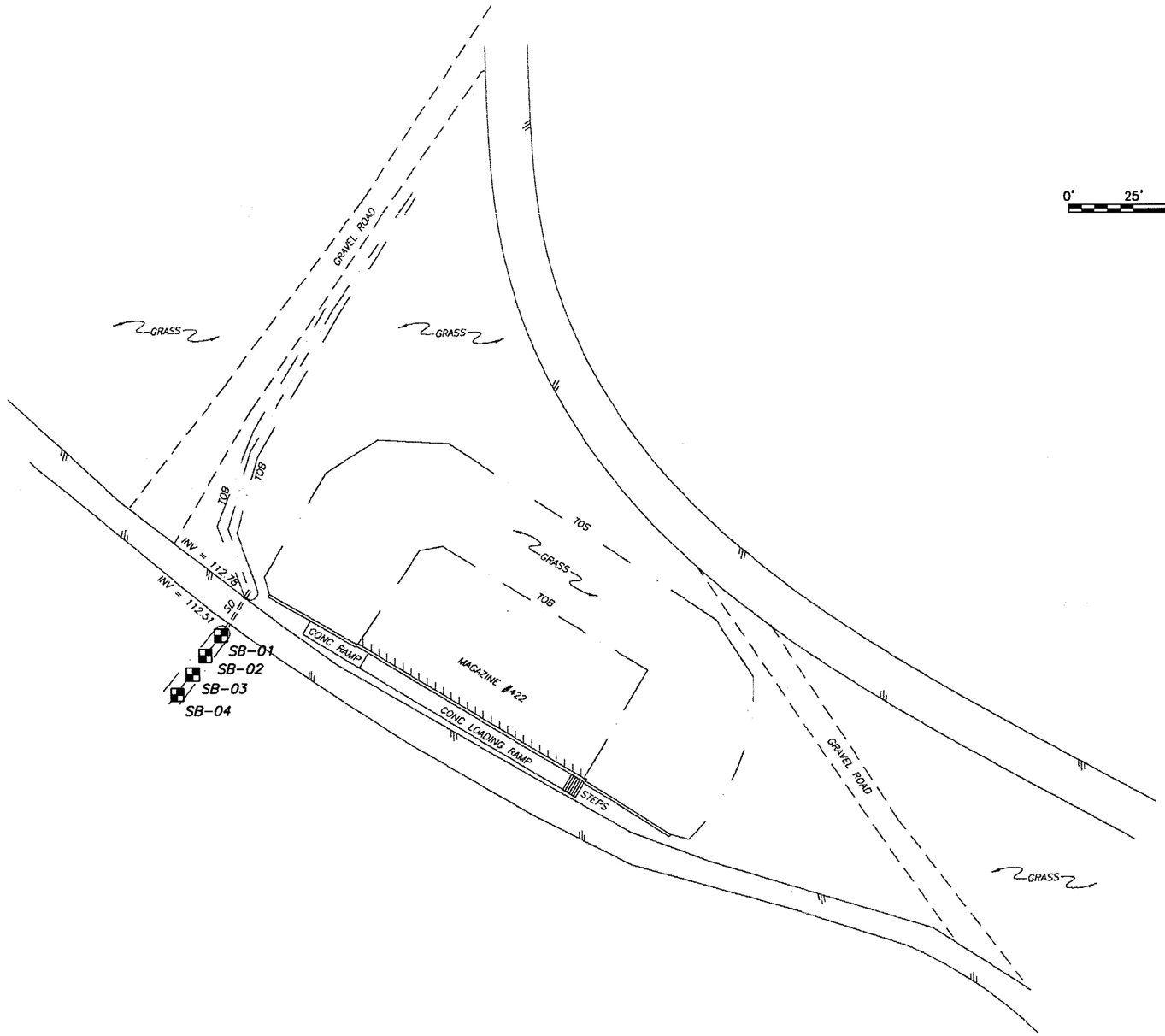
4.7.2 Subsurface Soil

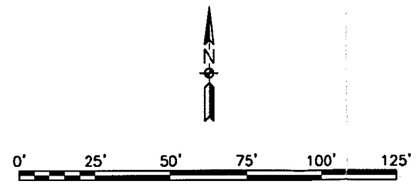
No constituents were detected above risk-based criteria in subsurface soils. No evidence exists to indicate that a release of hazardous materials to subsurface soil has occurred as a result of site-related activities. As a result, no additional subsurface soil investigations are recommended.

Table 4-1
Surface Soil Analytical Data Summary
SWMU-05, NASD - Vieques, PR

	StationID		Screening Criteria			W5-SB01	W5-SB02	W5-SB03	W5-SB04
	SampleID					NDA084	NDA086	NDA088	NDA091
	Collection Depth					0 To 0.5	0 To 0.8	0 To 2	0 To 2
	Date Collected					04/13/2000 12:50	04/14/2000 9:20	04/14/2000 11:00	04/17/2000 9:50
Parameter	Units	BKG	RBC-I (I)	RBC-R (R)	SSL (L)				
Semi-Volatiles									
FLUORANTHENE	MG/KG		8176.00	312.86	6254.64	0.068 J	0.364 U	0.346 U	0.041 J
PYRENE	MG/KG		6132.00	234.64	682.00	0.065 J	0.364 U	0.346 U	0.067 J
BENZO(a)ANTHRACENE	MG/KG		7.84	0.87	1.46	0.023 J	0.364 U	0.346 U	0.038 J
CHRYSENE	MG/KG		784.00	87.50	146.09	0.062 J	0.364 U	0.346 U	0.06 J
BENZO(b)FLUORANTHENE	MG/KG		7.84	0.87	4.51	0.144 J	0.364 U	0.346 U	0.05 J
BENZO(k)FLUORANTHENE	MG/KG		78.40	8.75	45.14	0.074 J	0.364 U	0.346 U	0.059 J
BENZO(a)PYRENE	MG/KG		0.78	0.087	0.37	0.088 J - R - -	0.364 U	0.346 U	0.075 J
INDENO(1,2,3-c,d)PYRENE	MG/KG		7.84	0.87	12.73	0.037 J	0.364 U	0.346 U	0.068 J
BENZO(g,h,i)PERYLENE	MG/KG			0.87	12.73	0.041 J	0.364 U	0.346 U	0.093 J
Volatiles									
CARBON DISULFIDE	MG/KG			780.00	19.00	0.013 UJ	0.0007 J	0.0005 J	0.0006 J
METHYL ETHYL KETONE (2-BUTANONE)	MG/KG			4700.00	7.90	0.002 J	0.011 R	0.01 R	0.011 R
TOLUENE	MG/KG		40880	1564.29	8.79	0.0004 J	0.011 U	0.01 U	0.011 U
STYRENE	MG/KG			1600.00	57.00	0.013 UJ	0.011 U	0.01 U	0.0006 J

The risk-based concentrations are based on a hazard quotient (HQ) of 0.1 and an excess lifetime cancer risk of 10 -6.
BKG = background (2 times average) values from AFWTF Camp Garcia Western Perimeter Study (November 1999)
Industrial RBC = EPA Region III Risk Based Concentration for Soil (Industrial)
Residential RBC = EPA Region III Risk Based Concentration for Soil (Residential)
SSL = EPA Region III Soil Screening Level for Groundwater Migration (with a dilution factor (DAF) of 20





LEGEND

- BUILDING
- BITUMINOUS PAVEMENT
- STORM DRAIN (SD)
- DITCH/SWALE/EDGE OF WATER
- TOP OF BANK (TOB)
- TOE OF SLOPE (TOS)
- SOIL BORING (SB-01)

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Figure 4-1 SWMU-5
Sample Locations
Naval Ammunition Support Detachment, Vieques Island

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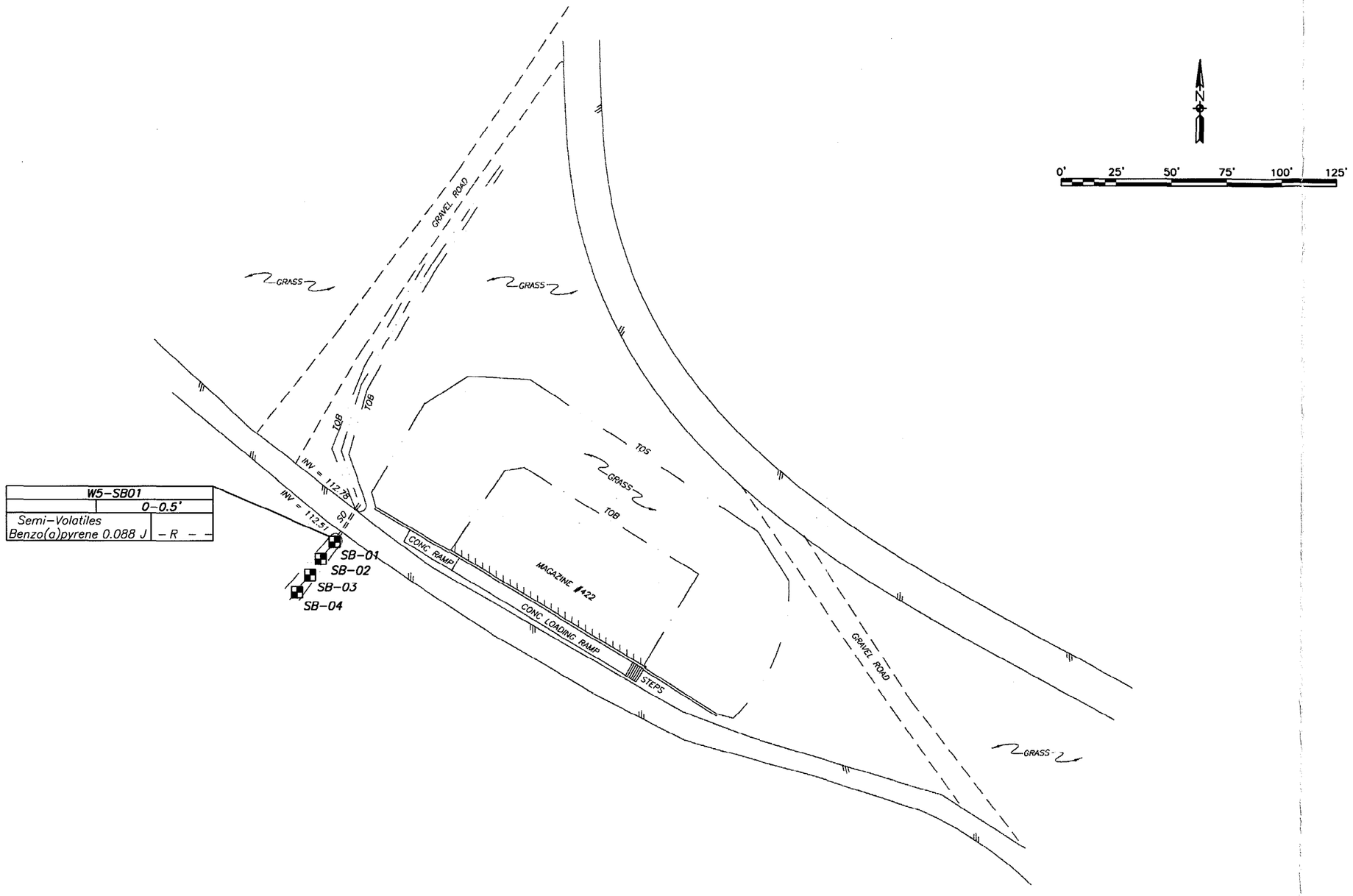

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Figure 4-2 SWMU-5
Soil Detections Above Screening Criteria
Naval Ammunition Support Detachment, Vieques Island

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SECTION 5

SWMU 06 Mangrove Disposal Site

This section presents the results of the Expanded PA/SI investigation performed at SWMU 06 –Mangrove Disposal Site at NASD, Vieques, Puerto Rico. The field sampling activities associated with this investigation were performed by CH2M HILL in April and June, 2000.

This section includes a description of the objectives of the Expanded PA/SI, a site description, results of previous investigations, summary of field activities, summary of laboratory results, and conclusions and recommendations. To evaluate the potential for environmental impacts from the site, data were compared to applicable regulatory screening and preliminary background values. A description of the environmental screening process was presented in Section 2.14 of this report.

5.1 Objectives

The specific objectives of this investigation were to:

1. Determine if a release of hazardous materials has occurred as a result of site-related activities; and
2. Assess whether the site is a candidate for closeout as a NFRAP site, or
3. Determine if further investigation or evaluation are warranted at this SWMU.

5.2 Site Description

The Mangrove Disposal Site is located in an 18-acre ocean-side mangrove swamp in Laguna Arenas along North Shore Road (Route 70) on the NASD. There is no known history of permits pertaining to this site. The disposal site was in use during the 1960s and 1970s, and was used as a base disposal area.

The waste materials extend northeast from the Laguna Kiani Bridge approximately 300 feet into the mangrove swamp for 100 to 120 feet in a northerly direction, and about 10 feet in a southerly direction from North Shore Road. Trash disposed of at this site included cans of

lubricants and oil, solvents, paints, and rubble. An IAS team has estimated that approximately 800 cubic yards of material was disposed. Much of the waste is scrap metal and solid waste.

5.2.1 Summary of Qualitative Ecological Survey

SWMU 6 is dominated by black (*Avicennia germinans*) and red mangrove (*Rhizophora mangle*) communities located between Laguna Kiani and the Caribbean Sea. The red mangroves were located along the intertidal zone where there is frequent saturation/inundation of seawater while the black mangroves were located further inland on higher ground. No endangered or threatened plant species were observed within SWMU 6 during the field survey.

The red mangrove community was sparsely vegetated (approximately 25 percent cover) with large pools of open water. The majority of red mangrove were a monotypic stand of shrubs with scattered red mangrove seedlings. The black mangrove community was sparse with approximately 25 percent of total cover. Plants were predominately short shrubs (8-15 feet); however, there were some patches of herbaceous vegetation located on higher topography. Other shrub vegetation included *Laguncularia racemosa, Prosopis glandulosa,* and *Acacia farnesiana.* The herbaceous vegetation was dominated by *Sporobolus virginicus, Heliotropium curassavicum, Sesuvium portulacastrum,* and *Blutaparon vermiculare.* There were no observed stresses in the plant communities.

During the wildlife surveys conducted on this site, a few wildlife species including birds and lizards were observed utilizing the habitat. Green heron, bananaquit, white-crowned dove, yellow warbler, common moorhen, pearly-eyed thrasher, zenaida dove, and anolis lizards were observed during the survey. The mangrove community also had significant crab activity. The red mangrove community, with more water present, had more crab burrows than the black mangrove community. There was no evidence that the SWMU site has had an impact on wildlife or habitat.

No endangered or threatened wildlife species were observed during the survey. The federally endangered tree *Stahlia monosperma* is known to occur in coastal forests of southeastern Puerto Rico (Little and Wadsworth 1964). One of the two known *Stahlia monosperma* populations is located on the eastern boundary of Laguna Kiani which is fairly

close to SWMU 6. No individuals of *Stahlia monosperma* were found at SWMU 6. Although this tree species has been found in Laguna Kiani, the habitat of SWMU 6 is a mixed mangrove community which is not preferred habitat of *Stahlia monosperma*.

Brown pelicans and roseate terns, both federally endangered marine birds were not observed during the field survey within SWMU 6, but have been known to occur at Laguna Kiani. During the surveys, brown pelicans were observed flying over the adjacent marine habitat, but were not observed using SWMU 6.

5.3 Previous Investigation Results

In April 1988, ESE prepared a Confirmation Study to determine possible dispersion and migration of specific chemicals at Roosevelt Roads and NASD, Vieques for the Atlantic Division, Naval Facilities Engineering Command (ESE, 1988). The objective of this Confirmation Study was to determine whether specific toxic or hazardous materials have contaminated the environment as a result of Navy activities. The results of this study are summarized below. No groundwater samples were previously collected at this site.

5.3.1 Surface Water and Sediment Samples

Five surface water and sediment samples were analyzed for pH, chromium (total and hexavalent), lead, VOCs, xylene, methyl ethyl ketone, and methyl isobutyl ketone. The surface water test results detected elevated total lead and chromium levels, but the levels were within ambient water quality criteria and drinking water criteria.

5.3.2 Soil Boring Samples

Eight soil samples were analyzed for pH, chromium (total and hexavalent), lead, VOCs, xylene, methyl ethyl ketone, and methyl isobutyl ketone. No elevated levels of any of these constituents were detected in the soil. Chromium and lead were found, however, in the sediment samples. These levels were not significant when compared to background metal concentrations found in soils.

5.4 Expanded PA/SI Field Investigation

The Expanded PA/SI for SWMU 06 was conducted in April and May 2000 and included geophysical surveys; UXO clearance; installation and sampling of four monitoring wells;

and collection of seven surface water/sediment samples, eight surface soil samples, and four subsurface (above the water table) soil samples. All samples were analyzed for metals, VOCs, SVOCs, pesticides, PCBs, and explosives. Figure 5-1 is a site map of SWMU 06 showing the sampling locations. Soil, surface water, and sediment samples were collected at similar locations to those identified in the 1988 confirmation study.

5.4.1 Geophysical Survey

A magnetometer survey was conducted to help delineate potential areas of buried metallic waste at SWMU 06. High concentrations of buried ferrous metal debris appear to be present in the northern portion of the site and under the road of the survey area. No ferrous debris appears to be present in the southern portion of the survey area. Because of the abundance of metal debris on the surface in some portions of the northern area, the survey was not able to determine whether buried ferrous metals are also present in these areas. Details of the magnetometer survey are included in Appendix G.

5.4.2 Unexploded Ordnance Clearance

During the geophysical surveys, UXO technicians were contracted to perform UXO avoidance surveys. Fifteen concrete-filled practice bombs were found near the surface during the surveys by the UXO technicians. The UXO report is included in Appendix H.

5.4.3 Monitoring Well Installation and Sampling

Based on the results of the magnetometer surveys, four monitoring wells were installed to determine whether groundwater has been impacted.

Prior to sampling, the depths to groundwater were measured using an electronic water level indicator. These data was used in conjunction with the survey data to determine elevations of groundwater at each monitoring well. As shown in Figure 5-2, the groundwater flow direction is to the south.

5.4.4 Soil Sampling

Eight soil borings were installed in the area of the initial magnetometer survey. One surface soil sample and one subsurface soil sample were collected from each of the eight soil

borings. In addition to laboratory analysis, soil samples were screened in the field using an OVM.

5.4.5 Surface Water

Seven surface water samples were collected in Laguna Kiani as part of the investigation activities. The samples were collected off-shore near locations where samples were collected in 1988 confirmation study. Additionally, two samples (SW/SD 06 and 07) were collected from background areas of the lagoon.

5.4.6 Sediment Sampling

Seven sediment samples were collected at the locations of the surface water samples.

5.5 Field Screening Results

Soil samples were screened in the field for VOCs using an OVM. This field screening method provides a qualitative evaluation of potential organic constituents in soil. The OVM results for the site are summarized in Appendix B. The results indicate that all OVM readings were 0.0 ppm for soil samples collected, at SWMU 06, indicating that no release of organic constituents had occurred at this site.

5.6 Laboratory Analytical Results

The following section presents the interpretation of the analytical data from the SWMU 06 Expanded PA/SI investigation. The discussion includes the identification of screening/regulatory criteria exceedances, as well as exceedances of upgradient, and background concentrations for the individual media sampled. Conclusions and recommendations, by media, are presented in Section 5.7.

Concentrations of detected chemicals were compared to the following current USEPA screening criteria for each matrix:

- Residential and industrial risk-based concentrations (RBCs) and soil screening level criteria for soil
- Tap water RBCs and drinking water Maximum Contaminant Levels (MCLs) for groundwater

- Ambient Water Quality Criteria (AWQC) for surface water
- Florida Sediment Quality Assessment Guidance (SQAG) for sediment

Soil background criteria were obtained from data collected from Camp Garcia.

Appendix J contains a compilation of the concentrations for all chemicals for which samples were analyzed. Appendix K contains a data validation summary.

5.6.1 Groundwater Results

Analytical results from unfiltered (total metals) samples indicate detections of aluminum, antimony, arsenic, barium, cadmium, iron, lead, and manganese in groundwater samples at concentrations exceeding the MCLs and/or Tap Water RBCs. Filtered metals (dissolved) results show detections of barium, cadmium, and manganese above the MCLs and/or Tap Water RBCs. The detected metals in the downgradient wells were detected at relatively similar concentrations in the upgradient wells, indicating that the detections are likely the result of background levels and are not site-related.

The polychlorinated biphenyls (PCBs) Arochlor 1221 and Arochlor 1232 were detected in groundwater samples at concentrations exceeding the MCL and/or RBC. Arochlor 1221 was detected in a single monitoring well (SWMU 06 - MW04) at a concentration of 0.0007 mg/L, which slightly exceeded the drinking water standard of 0.0005 mg/L.

VOCs, SVOCs, pesticides, and explosives were either not detected, or were detected at concentrations below their applicable screening criteria Table 5-1 summarizes the groundwater detections which are graphically presented on Figure 5-3.

5.6.2 Surface Soil Results

Analytical results indicate detections of aluminum, antimony, arsenic, chromium, copper, iron, lead, manganese, thallium, vanadium, zinc, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, fluoranthene, naphthalene, phenanthrene, and pyrene in surface soil at concentrations above the human health, leachability, and/or ecological screening criteria.

The detected metals were detected in all surface soil samples at relatively similar concentrations, indicating that the detections are likely the result of background levels and are not site-related. The SVOCs were detected in two surface samples (SB01 and SB05) at

concentrations slightly exceeding the residential RBCs and/or leachability criteria. Benzo(a)pyrene was detected in SB05 at a concentration exceeding the industrial RBC.

VOCs, pesticides, PCBs, and explosives were either not detected, or were detected at concentrations below their applicable screening criteria Table 5-2 summarizes the surface soil detections, which are presented graphically on Figure 5-4.

5.6.3 Subsurface Soil Results

Arsenic was detected in four subsurface soil samples above the leachability criterion. However, the arsenic concentrations were within the range of the soil background levels.

VOCs, SVOCs, pesticides, PCBs, and explosives were either not detected, or were detected at concentrations below their applicable screening criteria Table 5-3 summarizes subsurface soil detections, which are presented graphically on Figure 5-4.

5.6.4 Surface Water

Arsenic, copper, lead, mercury, and silver were detected in surface water samples at concentrations exceeding the human health, acute ecological and/or chronic ecological screening criteria.

VOCs, SVOCs, pesticides, PCBs, and explosives were either not detected, or were detected at concentrations below their applicable screening criteria. Table 5-4 summarizes the surface water detections, which are presented graphically on Figure 5-5.

5.6.5 Sediment

Arsenic, chromium, lead, nickel, and zinc were detected in a single sediment sample (SD02) at concentrations exceeding the SQAG and/or NOAA criteria. Copper was detected in all sediment samples at similar concentrations and below background criteria, and is likely attributed to background conditions.

VOCs, SVOCs, pesticides, PCBs, and explosives were either not detected, or were detected at concentrations below their applicable screening criteria. Table 5-5 summarizes the sediment detections, which are presented graphically on Figure 5-5.

5.7 Conclusion and Recommendations

This section summarizes the results of the Expanded PA/SI activities by media, and provides recommendations for each media sampled.

5.7.1 Groundwater

Several metals were detected in groundwater at concentrations exceeding the Tap Water RBCs and/or MCLs. The metals were detected in all wells at relatively similar concentrations, indicating that the detections are likely indicative of background conditions and are not site-related. VOCs, SVOCs, pesticides, and explosives were either not detected, or were detected at concentrations below their applicable screening criteria.

PCBs were detected in a single monitoring well, which is likely the result of site-related activities. Therefore, evidence exists to indicate that a release of site-related materials to groundwater has occurred as a result of site-related activities. The recommendation for groundwater is for further assessment through a Full RI/FS including a risk assessment.

5.7.2 Surface Soil

Analytical results indicate detections of metals and PAHs in surface soil samples at concentrations exceeding the residential and Industrial RBC criteria. The metals were detected at similar concentrations, indicating that the detections are likely indicative of background conditions and are not site-related. The detected PAHs are likely the result of site-related activities.

Evidence exists to indicate that a release of site-related materials to surface soil has occurred as a result of site-related activities. An additional background soil investigation is recommended to further characterize the background metal concentrations in soils. Also, additional soil sampling is recommended to delineate the extent of PAHs in the soils. The soil sampling should occur under the Full RI/FS and should include a risk assessment.

5.7.3 Subsurface Soil

Arsenic was detected in all four subsurface soil samples above the leachability criterion. However, the arsenic concentrations were all below the soil background criteria and were detected at similar concentrations, indicating that the detections are likely indicative of background conditions and are not site-related.

VOCs, SVOCs, pesticides, and explosives were either not detected, or were detected at concentrations below their applicable screening criteria. No evidence exists to indicate that a release to subsurface soil has occurred as a result of site-related activities. An additional soil background investigation is recommended to confirm the range of background metal concentrations within the soils.

5.7.4 Surface Water

Several metals were detected in surface water samples at concentrations exceeding the human health, acute ecological and/or chronic ecological screening criteria. The same metals detected in surface water were also detected in sediment samples, indicating that the metals may be from site-related activities. Evidence exists to indicate that a release of site-related materials to surface water has occurred as a result of site-related activities. Additional surface water and sediment sampling is recommended through the Full RI/FS process to characterize the extent of site-related constituents. In addition, a risk assessment is recommended to evaluate potential risks to human health and the environment.

5.7.5 Sediment

Several metals were detected in a single sediment sample (SD02) at concentrations exceeding the SQAG and/or NOAA criteria. Because the metals exceedance in this sample were significantly higher than in surrounding sediment samples, it is likely that the detections are result of site-related activities. Evidence exists to indicate that a release of site-related materials to sediment has occurred as a result of site-related activities. The recommendation for sediment is for further investigation through a Full RI/FS.

5.7.6 Institutional Controls

The site will be demarcated by using posts, chains, and signs along the roadway. The institutional controls will remain in place until the final CERCLA process is completed.

Table 5-1
Groundwater Analytical Data Summary
SWMU 6, NASD - Vieques, PR

StationID					SWMU6-MW01	SWMU6-MW02	SWMU6-MW03	SWMU6-MW04
SampleID					NDA006	NDA008	NDA009	NDA005
Date Collected			Screening Criteria		05/02/2000 13:45	05/02/2000 12:55	05/02/2000 11:00	05/02/2000 10:00
Paramater Name	Units	BKG	Federal MCL (M)	Tapwater RBC (T)				
Dissolved Metals								
ANTIMONY, DISSOLVED	MG/L		0.01	0.0015	0.0014 U	0.0014 U	0.0018 J	0.0014 U
ARSENIC, DISSOLVED	MG/L	0.01	0.05	0.00004	0.0073 J	0.0048 J	0.0059 J	0.0133 =
BARIUM, DISSOLVED	MG/L	0.28	2.00	0.26	0.481 = - T	0.294 = - T	0.179 J	0.381 = - T
CALCIUM, DISSOLVED	MG/L				694 =	498 =	574 =	567 =
CADMIUM, DISSOLVED	MG/L	0.004	0.005	0.0018	0.0029 J - T	0.0018 J	0.002 J - T	0.002 J - T
CHROMIUM, DISSOLVED	MG/L	0.02	0.10	0.11	0.0047 J	0.0005 U	0.0005 U	0.0045 J
COBALT, DISSOLVED	MG/L	0.02		0.22	0.00055 J	0.0005 U	0.0005 U	0.00092 J
IRON, DISSOLVED	MG/L		0.30	1.10	0.0122 R	0.0127 J	0.0122 R	0.0122 R
LEAD, DISSOLVED	MG/L		0.01		0.003 J	0.0027 J	0.0038 =	0.0026 J
MAGNESIUM, DISSOLVED	MG/L				1520 =	1530 =	1530 =	1510 =
MANGANESE, DISSOLVED	MG/L		0.05	0.07	11.8 = M T	2.07 = M T	1.17 = M T	10.6 = M T
NICKEL, DISSOLVED	MG/L	0.02	0.10	0.07	0.0016 J	0.0021 J	0.001 J	0.004 J
SELENIUM, DISSOLVED	MG/L	0.02	0.05	0.02	0.0057 =	0.005 J	0.0021 U	0.0064 =
SILVER, DISSOLVED	MG/L				0.00093 J	0.0005 U	0.0005 U	0.0021 J
SODIUM, DISSOLVED	MG/L				7360 =	12200 =	12100 =	9720 =
VANADIUM, DISSOLVED	MG/L	0.04		0.03	0.0027 J	0.0045 J	0.0048 J	0.0081 J
Total Metals								
ALUMINUM	MG/L		0.05	3.65	**0.306** = M -	**1.46** = M -	**0.182** J M -	**0.164** J M -
ANTIMONY	MG/L		0.01	0.0015	0.0014 U	**0.0037** J - T	0.0014 U	0.0014 U
ARSENIC	MG/L	0.01	0.05	0.00004	**0.0068** J - T	**0.0035** J - T	**0.0065** J - T	**0.01** = - T
BARIUM	MG/L	0.28	2.00	0.26	**0.519** = - T	**0.283** = - T	0.194 J	**0.425** = - T
BERYLLIUM	MG/L	0.000	0.004	0.007	0.00032 J	0.00044 J	0.00042 J	0.00033 J
CADMIUM	MG/L	0.004	0.005	0.002	**0.0033** J - T	**0.002** J - T	**0.0028** J - T	**0.0028** J - T
CALCIUM	MG/L				860 =	555 =	712 =	691 =
CHROMIUM, TOTAL	MG/L	0.02	0.10	0.11	0.0057 J	0.0042 J	0.0027 J	0.0089 J
COBALT	MG/L	0.02		0.22	0.004 J	0.0005 U	0.0005 U	0.0017 J
COPPER	MG/L	0.04	1.00	0.15	0.0019 U	0.01 J	0.0019 U	0.0019 U
IRON	MG/L		0.30	1.10	**0.324** J M -	**2.5** J M T	0.043 J	0.0555 J
LEAD	MG/L		0.01		0.0035 =	**0.0252** = M -	0.0018 J	0.0043 =
MAGNESIUM	MG/L				1580 =	1570 =	1590 =	1570 =
MANGANESE	MG/L		0.05	0.07	**14.3** = M T	**2.07** = M T	**1.38** = M T	**13.8** = M T
NICKEL	MG/L	0.02	0.10	0.07	0.0027 J	0.0037 J	0.0015 J	0.0044 J
SELENIUM	MG/L	0.02	0.05	0.02	0.0072 =	0.0029 J	0.0059 =	0.0071 =
SODIUM	MG/L				9740 =	11800 =	11900 =	11800 =
VANADIUM	MG/L	0.04		0.03	0.0037 J	0.0099 J	0.006 J	0.0075 J
ZINC	MG/L	0.14	5.00	1.10	0.0125 U	0.0125 U	0.0125 U	0.177 =
PCBs								
PCB-1221 (AROCHLOR 1221)	MG/L		0.0005	0.00003	0.00043 U	0.00042 U	0.00043 U	**0.0007** = M T
PCB-1232 (AROCHLOR 1232)	MG/L		0.0005	0.00003	0.00022 U	0.00021 U	0.00022 U	**0.00009** J - T

Table 5-2
Surface Soil Analytical Data Summary
SWMU-06, NASD - Vieques, PR

Parameter	Units	BKG	Industrial RBC (I)	Residential RBC (R)	SSL (L)	W6-SB01 NDA101 0 To 0.5 04/24/2000 13:00	W6-SB01 NDA102 1 To 1.5 04/24/2000 13:15	W6-SB02 NDA103 0 To 0.5 04/24/2000 13:40	W6-SB02 NDA105 0.7 To 1.2 04/24/2000 14:00	W6-SB03 NDA107 0 To 0.5 04/24/2000 9:45	W6-SB03 NDA108 1 To 1.5 04/24/2000 10:00	W6-SB04 NDA109 0 To 0.5 04/24/2000 10:10	W6-SB04 NDA110 0.5 To 0.7 04/24/2000 10:15	W6-SB05 NDA111 0 To 0.5 04/24/2000 10:30	W6-SB06 NDA113 0 To 0.5 04/20/2000 14:10	W6-SB07 NDA115 0 To 0.5 04/20/2000 14:50	W6-SB08 NDA117 0 To 0.5 04/20/2000 15:25
Metals																	
ALUMINUM	MG/KG		204400.00	7821.43		5170 =	9320 = - R -	4900 =	5860 =	5810 =	5440 =	10900 = - R -	10300 = - R -	11600 = - R -	14000 = - R -	11100 = - R -	12200 = - R -
ANTIMONY	MG/KG	1.76	81.76	3.13	13.20	13.3 J - R L	4.1 J - R -	0.19 UJ	0.61 J	1 J	0.93 J	0.47 J	0.53 J	0.82 J	0.74 J	0.34 J	0.46 J
ARSENIC	MG/KG	2.08	3.82	0.43	0.03	7.6 = I R L	2.2 J - R L	1.9 J - R L	0.76 J - R L	1.6 J - R L	2 J - R L	0.93 J - R L	1 J - R L	1.5 J - R L	1 J - R L	1.1 J - R L	0.99 J - R L
BARIUM	MG/KG	167.17	14308.00	547.50	2105.32	19.3 J	20.4 J	12.8 J	12.9 J	26.5 J	27.9 J	36.1 J	19.3 J	18.2 J	29.5 J	28.8 J	37.6 J
BERYLLIUM	MG/KG	0.58	408.80	15.64	1153.69	0.041 U	0.048 J	0.042 U	0.049 U	0.054 J	0.055 J	0.12 J	0.14 J	0.069 J	0.12 J	0.11 J	0.11 J
CADMIUM	MG/KG	0.35	102.20	3.91	27.45	0.33 J	0.44 J	0.35 J	0.33 J	0.028 J	0.027 U	1.4 =	0.48 J	0.61 J	0.025 U	0.023 U	0.23 J
CALCIUM	MG/KG					90500 J	86500 J	134000 J	122000 J	97200 J	88400 J	70800 J	40100 J	108000 J	35400 J	64900 =	65800 =
CHROMIUM, TOTAL	MG/KG	45.92	450.00	210.00	40.00	28 =	11.6 =	6.4 =	5.7 =	12.9 =	9.7 =	14.3 =	17.8 =	14.9 =	42.9 = - - L	35.7 =	23.3 =
COBALT	MG/KG	39.41	12264.00	469.29		6 J	3.5 J	2.4 J	2.1 J	4 J	4.2 J	8.9 J	9.4 J	3.3 J	12.8 =	11.5 =	9.1 J
COPPER	MG/KG	147.78	8176.00	312.86	10517.84	121 =	51.5 =	16.1 =	15 =	38.7 =	35.7 =	36.8 =	38.2 =	250 =	114 J	52.3 J	114 J
IRON	MG/KG	9360.00	61320.00	2346.43		75200 = I R -	21900 = - R -	8920 = - R -	7330 = - R -	16000 = - R -	17900 = - R -	20600 = - R -	25100 = - R -	16100 = - R -	22900 = - R -	16900 = - R -	18500 = - R -
LEAD	MG/KG	4.19	100.00	40.00		617 = I R -	332 = I R -	17.5 =	25.8 =	104 = I R -	97.8 = - R -	22.5 =	16.9 =	67.5 = - R -	36.1 =	3.9 =	25.8 =
MAGNESIUM	MG/KG					5180 =	5580 =	4180 =	3810 =	3800 =	3130 =	6870 =	8130 =	5750 =	9050 =	6600 =	7630 =
MANGANESE	MG/KG	2516.77	4088.00	1600.00	950.00	415 =	227 =	128 =	117 =	276 =	219 =	331 =	295 =	137 =	465 J	390 J	379 J
MERCURY	MG/KG	0.04	61.32	2.35	2.10	0.081 J	0.053 J	0.015 UJ	0.042 J	0.081 J	0.072 J	0.019 UJ	0.012 UJ	0.038 J	0.014 U	0.013 U	0.016 U
NICKEL	MG/KG	32.18	4088.00	156.43	100.00	13 =	5.1 J	2.4 J	2.3 J	4.4 J	4.5 J	9.2 J	9.7 J	4 J	20 =	16.5 =	10.7 =
POTASSIUM	MG/KG					1740 J	2630 J	1900 J	2670 J	1820 J	1810 J	2700 J	2510 J	2610 J	1460 =	1570 =	2440 =
SILVER	MG/KG		1022.00	39.11	31.03	0.36 J	0.11 J	0.069 U	0.081 U	0.14 J	0.27 J	0.099 J	0.066 U	0.12 J	0.41 J	0.057 U	0.13 J
SODIUM	MG/KG					12100 =	16500 =	13700 =	15400 =	6300 =	6120 =	5390 =	4200 =	14200 =	3250 =	4700 =	4040 =
THALLIUM	MG/KG		14.31	0.55	3.64	4.3 = - R L	1.5 J - R -	0.37 U	0.44 U	0.34 U	1.3 J - R -	0.77 J - R -	1.5 J - R -	0.82 J - R -	0.34 U	0.31 U	0.34 U
VANADIUM	MG/KG	169.89	1430.80	54.75	5111.02	23.2 =	27.9 =	19.9 =	20.7 =	27.7 =	27.3 =	65.8 = - R -	80.2 = - R -	26.5 =	66 = - R -	51.2 =	51 =
ZINC	MG/KG	132.11	61320.00	2346.43	13621.80	438 =	216 =	42 =	37.5 =	82.2 =	68.1 =	86.3 =	58.1 =	138 =	96.5 =	29.5 =	83.7 =
Pesticides																	
p,p'-DDE	MG/KG		16.83	1.88	35.22	0.029 J	0.03 J	0.0038 J	0.011 J	0.0067 J	0.0058 J	0.0012 J	0.00088 J	0.0075 J	0.074 J	0.0018 J	0.046 J
p,p'-DDD	MG/KG		23.85	2.66	11.16	0.011 J	0.013 J	0.0045 UJ	0.00084 J	0.0042 UJ	0.001 J	0.00062 J	0.0044 UJ	0.002 J	0.0041 UJ	0.0038 UJ	0.013 J
p,p'-DDT	MG/KG		16.83	1.88	1.16	0.0072 J	0.0052 UJ	0.0045 UJ	0.0053 UJ	0.003 J	0.0018 J	0.0043 UJ	0.0044 UJ	0.0044 UJ	0.017 J	0.0038 UJ	0.007 J
ALPHA-CHLORDANE	MG/KG		16.35	1.82	0.92	0.0023 UJ	0.0026 UJ	0.0023 UJ	0.0027 UJ	0.0021 UJ	0.0023 UJ	0.0022 UJ	0.0023 UJ	0.0022 UJ	0.00061 J	0.0019 UJ	0.0021 UJ
Semi-Volatile Organics																	
NAPHTHALENE	MG/KG		4088.00	156.43	0.15	0.549 U	0.684 U	0.627 U	0.748 U	0.506 U	0.637 U	0.503 U	0.567 U	0.621 = - - L	0.551 U	0.558 U	0.76 U
2-METHYLNAPHTHALENE	MG/KG		4088.00	156.43	22.23	0.549 U	0.684 U	0.627 U	0.748 U	0.506 U	0.637 U	0.503 U	0.567 U	0.311 J	0.551 U	0.558 U	0.76 U
ACENAPHTHENE	MG/KG			470.00	100.00	0.549 U	0.684 U	0.627 U	0.748 U	0.506 U	0.637 U	0.503 U	0.567 U	0.684 =	0.551 U	0.558 U	0.76 U
DIBENZOFURAN	MG/KG			31.00	7.70	0.549 U	0.684 U	0.627 U	0.748 U	0.506 U	0.637 U	0.503 U	0.567 U	0.784 =	0.551 U	0.558 U	0.76 U
FLUORENE	MG/KG		8176.00	312.86	135.29	0.549 U	0.684 U	0.627 U	0.748 U	0.506 U	0.637 U	0.503 U	0.567 U	0.44 J	0.551 U	0.558 U	0.76 U
PHENANTHRENE	MG/KG			234.64	682.00	0.549 U	0.085 J	0.627 U	0.748 U	0.506 U	0.637 U	0.503 U	0.567 U	4.86 =	0.551 U	0.558 U	0.76 U
ANTHRACENE	MG/KG		61320.00	2346.43	465.60	0.549 U	0.038 U	0.627 U	0.748 U	0.506 U	0.637 U	0.503 U	0.567 U	0.902 =	0.551 U	0.558 U	0.76 U
FLUORANTHENE	MG/KG		8176.00	312.86	6254.64	0.034 U	0.125 J	0.627 U	0.748 U	0.506 U	0.637 U	0.503 U	0.567 U	4.06 =	0.551 U	0.558 U	0.05 J
PYRENE	MG/KG		6132.00	234.64	682.00	0.037 J	0.195 J	0.627 U	0.748 U	0.506 U	0.637 U	0.503 U	0.567 U	2.9 =	0.033 J	0.558 U	0.051 J
BENZO(a)ANTHRACENE	MG/KG		7.84	0.87	1.46	0.549 U	0.1 J	0.627 U	0.748 U	0.506 U	0.637 U	0.503 U	0.567 U	1.87 = - R L	0.551 U	0.558 U	0.041 J
CHRYSENE	MG/KG		784.00	87.50	146.09	0.549 U	0.122 J	0.627 U	0.748 U	0.506 U	0.637 U	0.503 U	0.567 U	2 =	0.052 J	0.558 U	0.118 J
bis(2-ETHYLHEXYL) PHTHALATE	MG/KG			46.00	2900.00	1.4 =	0.684 U	0.627 U	0.748 U	0.506 U	0.135 J	0.503 U	0.567 U	0.607 U	0.135 J	0.558 U	0.76 U
BENZO(b)FLUORANTHENE	MG/KG		7.84	0.87	4.51	0.549 U	0.081 J	0.627 U	0.748 U	0.506 U	0.033 U	0.503 U	0.567 U	1.8 = - R -	0.068 J	0.558 U	0.121 J
BENZO(k)FLUORANTHENE	MG/KG		78.40	8.75	45.14	0.549 U	0.075 J	0.627 U	0.748 U	0.506 U	0.045 U	0.503 U	0.567 U	1.23 =	0.059 J	0.558 U	0.088 J
BENZO(a)PYRENE	MG/KG		0.78	0.09	0.37	0.549 U	0.123 J - R -	0.627 U	0.748 U	0.506 U	0.637 U	0.503 U	0.567 U	1.51 = I R L	0.052 J	0.558 U	0.081 J
INDENO(1,2,3-c,d)PYRENE	MG/KG		7.84	0.87	12.73	0.549 U	0.07 J	0.627 U	0.748 U	0.506 U	0.637 U	0.503 U	0.567 U	0.653 =	0.05 J	0.558 U	0.074 J
DIBENZ(a,h)ANTHRACENE	MG/KG		0.78	0.09	1.39	0.549 U	0.684 U	0.627 U	0.748 U	0.506 U	0.637 U	0.503 U	0.567 U	0.254 J - R -	0.551 U	0.558 U	0.76 U
BENZO(g,h,i)PERYLENE	MG/KG			0.87	12.73	0.549 U	0.069 J	0.627 U	0.748 U	0.506 U	0.637 U	0.503 U	0.567 U	0.432 J	0.04 J	0.558 U	0.056 J
CARBAZOLE	MG/KG		286.16	31.94	0.47	0.549 U	0.684 U	0.627 U	0.748 U	0.506 U	0.637 U	0.503 U	0.567 U	0.431 J	0.551 U	0.558 U	0.76 U
Volatile Organics																	
CARBON DISULFIDE	MG/KG			780.00	19.00	0.002 J	0.002 J	0.002 J	0.004 J	0.012 U	0.002 J	0.011 U	0.011 U	0.0007 J	0.01 U	0.01 U	0.01 UJ
METHYL ETHYL KETONE (2-BUTANONE)	MG/KG			4700.00	7.90	0.003 J	0.003 J	0.013 R	0.017 R	0.012 R	0.013 R	0.011 R	0.011 R	0.012 R	0.01 R	0.01 R	0.01 R
BENZENE	MG/KG		197.35	22.03	0.00	0.014 U	0.014 U	0.013 U	0.0002 J	0.012 U	0.013 U	0.011 U	0.011 U	0.012 U	0.01 U	0.01 U	0.01 UJ
TOLUENE	MG/KG		40880.00	1564.29	8.79	0.014 U	0.014 U	0.013 U	0.0009 J	0.012 U	0.013 U	0.011 U	0.011 U	0.012 U	0.01 U	0.01 U	0.0008 J
TETRACHLOROETHYLENE(PCE)	MG/KG		110.00	12.00	0.05	0.014 U	0.014 U	0.013 U	0.002 J	0.012 U	0.013 U	0.011 U	0.011 U	0.012 U	0.01 U	0.01 U	0.01 UJ
ETHYLBENZENE	MG/KG		20000.00	780.00	15.00	0.014 U	0.014 U	0.013 U	0.001 J	0.012 U	0.013 U	0.011 U	0.011 U	0.012 U	0.01 U	0.01 U	0.001 J
M,P-XYLENE (SUM OF ISOMERS)	MG/KG			16000.00	170.00	0.0007 J	0.0006 J	0.013 U	0.017 U	0.012 U	0.013 U	0.011 U	0.011 U	0.012 U	0.01 U	0.01 U	0.004 J
O-XYLENE (1,2-DIMETHYLBENZENE)	MG/KG		408800.00	15642.86	229.95	0.014 U	0.014 U	0.013 U	0.002 J	0.012 U	0.013 U	0.011 U	0.011 U	0.012 U	0.01 U	0.01 U	0.002 J
XYLENES, TOTAL	MG/KG		408800.00	15642.86	170.19	0.0007 J	0.0006 J	0.013 U	0.017 U	0.012 U	0.013 U	0.011 U	0.011 U	0.012 U	0.01 U	0.01 U	0.006 J

The risk-based concentrations are based on a hazard quotient (HQ) of 0.1 and an excess lifetime cancer risk of 10 -6.
BKG = background (2 times average) values from AFWTF Camp Garcia Western Perimeter Study (November 1999)
Industrial RBC = EPA Region III Risk Based Concentration for Soil (Industrial)
Residential RBC = EPA Region III Risk Based Concentration for Soil (Residential)
SSL = EPA Region III Soil Screening Level for Groundwater Migration (with a dilution factor (DAF) of 20

020210052

Table 5-3
Subsurface Soil Analytical Data Summary
SWMU 6, NASD - Vieques, PR

StationID				W6-SB05	W6-SB06	W6-SB07	W6-SB08
SampleID				NDA112	NDA114	NDA116	NDA118
Collection Depth				3 To 3.5	1.8 To 2.3	2.3 To 3	2.3 To 3
Date Collected		Screening Criteria		04/24/2000 10:40	04/20/2000 14:20	04/20/2000 15:10	04/20/2000 16:00
Parameter Name	Units	BKG	SSL (L)				
Metals							
ALUMINUM	MG/KG			5190 =	12500 =	6470 =	7190 =
ANTIMONY	MG/KG	1.76	13.20	0.19 UJ	0.46 J	0.18 UJ	0.18 UJ
ARSENIC	MG/KG	2.08	0.03	1.2 J L	0.88 J L	1.1 J L	1.1 J L
BARIUM	MG/KG	167.17	2105.32	12.6 J	36.9 J	24 J	24.3 J
BERYLLIUM	MG/KG	0.58	1153.69	0.04 U	0.092 J	0.066 J	0.072 J
CADMIUM	MG/KG	0.35	27.45	0.63 J	0.29 J	0.16 J	0.14 J
CALCIUM	MG/KG			106000 J	91800 =	99400 =	93700 =
CHROMIUM, TOTAL	MG/KG	45.92	40.00	5.9 =	25.4 =	6.3 =	6.7 =
COBALT	MG/KG	39.41		1.9 J	8.2 J	2.2 J	2.2 J
COPPER	MG/KG	147.78	10517.84	34.4 =	137 J	37.1 J	10 J
IRON	MG/KG	9360.00		5910 =	15400 =	7980 =	8230 =
LEAD	MG/KG	4.19		8.8 =	16.1 =	2.3 =	2.8 =
MAGNESIUM	MG/KG			2920 =	5220 =	3130 =	3490 =
MANGANESE	MG/KG	2516.77	950.00	72 =	343 J	213 J	170 J
MERCURY	MG/KG	0.04	2.10	0.018 UJ	0.018 J	0.016 U	0.016 U
NICKEL	MG/KG	32.18	100.00	1.8 J	12.4 =	1.4 J	1.8 J
POTASSIUM	MG/KG			1590 J	1840 =	2220 =	2490 =
SELENIUM	MG/KG	1.85	18.98	0.28 U	0.27 U	0.26 U	0.29 J
SILVER	MG/KG		31.03	0.067 U	0.19 J	0.063 U	0.065 U
SODIUM	MG/KG			8370 =	4790 =	5710 =	6230 =
VANADIUM	MG/KG	169.89	5111.02	19.4 =	37.1 =	20.1 =	21.1 =
ZINC	MG/KG	132.11	13621.80	23.5 =	200 =	14.5 =	14.9 =
Pesticides							
p,p'-DDE	MG/KG		35.22	0.002 J	0.316 J	0.0042 UJ	0.0043 UJ
p,p'-DDD	MG/KG		11.16	0.00032 J	0.012 J	0.0042 UJ	0.0043 UJ
p,p'-DDT	MG/KG		1.16	0.0043 UJ	0.019 J	0.0042 UJ	0.0043 UJ
Semi-Volatiles							
FLUORANTHENE	MG/KG		6254.64	0.043 J	0.629 U	0.696 U	0.548 U
PYRENE	MG/KG		682.00	0.031 J	0.629 U	0.696 U	0.548 U
CHRYSENE	MG/KG		146.09	0.536 U	0.045 J	0.696 U	0.548 U
BENZO(b)FLUORANTHENE	MG/KG		4.51	0.536 U	0.087 J	0.696 U	0.548 U
BENZO(k)FLUORANTHENE	MG/KG		45.14	0.536 U	0.052 J	0.696 U	0.548 U
BENZO(a)PYRENE	MG/KG		0.37	0.536 U	0.059 J	0.696 U	0.548 U
INDENO(1,2,3-c,d)PYRENE	MG/KG		12.73	0.536 U	0.062 J	0.696 U	0.548 U
BENZO(g,h,i)PERYLENE	MG/KG		12.73	0.536 U	0.054 J	0.696 U	0.548 U
Volatiles							
CARBON DISULFIDE	MG/KG		19.00	0.001 J	0.011 U	0.006 J	0.006 J
BENZENE	MG/KG		0.002	0.0002 J	0.011 U	0.011 U	0.012 UJ

The risk-based concentrations are based on a hazard quotient (HQ) of 0.1 and an excess lifetime cancer risk of 10 -6.
BKG = background (2 times average) values from AFWTF Camp Garcia Western Perimeter Study (November 1999)
SSL = EPA Region III Soil Screening Level for Groundwater Migration (with a dilution factor (DAF) of 20

Table 5-4
Surface Water Analytical Data Summary
SWMU 6, NASD - Vieques, PR

StationID					W6-SW01	W6-SW02	W6-SW03	W6-SW04	W6-SW05	W6-SW06	W6-SW07
SampleID					NDA035	NDA036	NDA037	NDA039	NDA040	NDA300	NDA301
Date Collected		Ecological[1]		Human	04/13/2000 10:00	04/13/2000 9:30	04/13/2000 10:45	04/13/2000 13:30	04/13/2000 13:15	04/13/2000 14:30	04/13/2000 14:
		Acute	Chronic	Health[2]							
Parameter	Units	(A)	(C)	(H)							
Total Metals											
ALUMINUM	MG/L				1.82 =	1.44 =	1.68 =	2.02 =	1.37 =	2.26 =	2.97 =
ARSENIC	MG/L	0.069	0.036	0.00014	0.0034 U	**0.0038 J - - H**	0.0034 U	0.0034 U	**0.005 J - - H**	**0.0053 J - - H**	0.0034 U
BARIUM	MG/L				0.0127 J	0.0119 J	0.0123 J	0.0135 J	0.0122 J	0.0138 J	0.0151 J
CADMIUM	MG/L	0.042	0.0093		0.0019 J	0.0019 J	0.002 J	0.002 J	0.002 J	0.0019 J	0.0019 J
CALCIUM	MG/L				476 J	463 J	464 J	465 J	470 J	469 J	487 J
CHROMIUM, TOTAL	MG/L				0.0011 J	0.0005 U	0.0011 J	0.00063 J	0.00058 J	0.0005 U	0.00051 J
COBALT	MG/L				0.0005 U	0.0005 U	0.0011 J	0.0005 U	0.0005 U	0.0005 U	0.00071 J
COPPER	MG/L	0.0029	0.0029		0.0019 U	**0.0046 J A C -**	0.0019 J	0.002 J	0.0022 J	**0.005 J A C -**	0.0019 U
IRON	MG/L				0.887 J	0.7 J	0.761 J	0.883 J	0.614 J	0.979 J	1.41 J
LEAD	MG/L	0.21	0.0081		0.0011 U	0.0016 J	0.0011 U	0.0012 J	0.0011 U	**0.0147 = - C -**	0.0017 J
MAGNESIUM	MG/L				1540 =	1540 =	1560 =	1560 =	1550 =	1560 =	1560 =
MANGANESE	MG/L			0.10	0.0257 J	0.0198 J	0.0181 J	0.0189 J	0.0053 J	0.0213 J	0.0308 J
MERCURY	MG/L	0.0018	0.000025	0.000051	0.00018 R	0.00018 R	**0.0016 J - C H**	0.00018 R	0.00018 R	0.00018 R	0.00018 R
NICKEL	MG/L	0.074	0.0082	4.60	0.0008 U	0.0011 J	0.0008 U	0.0008 U	0.0008 U	0.0008 U	0.00096 J
POTASSIUM	MG/L				0.0266 U	0.0266 U	0.0266 U	0.0266 U	412 =	0.0266 U	0.0266 U
SELENIUM	MG/L	0.29	0.071	11.00	0.0052 =	0.0056 =	0.0064 =	0.0027 J	0.0042 J	0.004 J	0.0038 J
SILVER	MG/L	0.0019	0.00023		0.0025 U	0.0025 U	0.0025 U	0.0025 U	**0.0071 J A C -**	0.0025 U	0.0025 U
SODIUM	MG/L				6500 J	6370 J	6520 J	6270 J	6200 J	6240 J	6330 J
THALLIUM	MG/L	0.213	0.0213	0.0063	0.0027 U	0.0049 J	0.0027 U	0.0027 U	0.0027 U	0.0027 U	0.0027 U
VANADIUM	MG/L				0.0033 J	0.0036 J	0.0025 J	0.004 J	0.0037 J	0.0045 J	0.0058 J
Semi-Volatiles											
DIETHYL PHTHALATE	MG/L	0.759	0.0759	120.00	0.0006 J	0.0005 J	0.0005 J	0.01 U	0.011 U	0.01 U	0.011 U

[1] "National Recommended Water Quality Criteria," USEPA 822-Z-99-001, April 1999 (Marine Surface Water)

[2] "National Recommended Water Quality Criteria," USEPA 822-Z-99-001, April 1999. (Consumption of Organisms)

Table 5-5
Sediment Analytical Data Summary
SWMU 6, NASD - Vieques, PR

StationID			SQAG[1]		NOAA[2]	W6-SD01	W6-SD02	W6-SD03	W6-SD04	W6-SD05	W6-SD06	W6-SD07
SampleID						NDA042	NDA043	NDA044	NDA045	NDA046	NDA302	NDA303
Collection Depth						0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5
Date Collected						04/13/2000 10:00	04/13/2000 9:30	04/13/2000 10:45	04/13/2000 13:30	04/13/2000 13:15	04/13/2000 14:30	04/13/2000 14:10
Parameter	Units	BKG	TEL (T)	PEL (P)	ERL (E)							
Metals												
ALUMINUM	MG/KG					8400 =	6890 =	19300 =	12300 =	14800 =	5680 =	17800 =
ANTIMONY	MG/KG	1.76				0.72 J	97.8 J E	0.85 J	0.5 UJ	0.56 UJ	0.14 UJ	0.62 UJ
ARSENIC	MG/KG	2.08	7.24	41.60	8.20	2.3 J	**555 = T P E**	5.9 J	5.8 J	5.2 J	1.1 J	4 J
BARIUM	MG/KG	167.17				5.1 J	571 =	14.7 J	10.7 J	11.9 J	17.3 J	14.4 J
BERYLLIUM	MG/KG	0.58				0.082 J	14.2 =	0.25 J	0.18 J	0.25 J	0.16 J	0.29 J
CADMIUM	MG/KG	0.35				0.033 U	13.7 =	0.094 U	0.072 U	0.081 U	0.02 U	0.088 U
CALCIUM	MG/KG					30100 =	55800 =	46100 =	38600 =	30100 =	1630 =	14600 =
CHROMIUM, TOTAL	MG/KG	45.92	52.30	160	81	32.4 =	**67.8 = T - -**	16.9 =	13.9 =	15.6 =	4.6 =	12.9 =
COBALT	MG/KG	39.41				6.2 J	142 =	6.9 J	6.1 J	6.5 J	1.7 J	7.3 J
COPPER	MG/KG	147.78	18.70	108	34	**22.8 = T - -**	**101 = T - E**	**37.8 = T - E**	**29.8 = T - -**	**34.4 = T - E**	9.1 =	**28.9 = T - -**
IRON	MG/KG	9360.00				13100 =	10500 =	25700 =	21900 =	23900 =	5110 =	22400 =
LEAD	MG/KG	4.19	30.20	112.00	46.70	3.1 =	**144 = T P E**	21.8 =	13.8 =	14.2 =	1.5 =	8.3 =
MAGNESIUM	MG/KG					6340 =	5260 =	11600 =	8590 =	9710 =	2670 =	9840 =
MANGANESE	MG/KG	2516.77				133 =	277 =	237 =	226 =	237 =	30.2 =	225 =
MERCURY	MG/KG	0.04				0.18 J E	0.21 J E	0.05 UJ	0.052 UJ	0.047 UJ	0.0087 UJ	0.052 UJ
NICKEL	MG/KG	32.18	15.90	42.80	20.90	12.6 J	**143 = T P E**	6.1 J	4.9 J	5.4 J	1.8 J	4.8 J
POTASSIUM	MG/KG					1930 =	1290 J	6550 =	4530 =	5540 =	2070 =	6250 =
SELENIUM	MG/KG	1.85				0.35 U	544 =	2.2 J	0.96 J	1.3 J	0.8 J	1.4 J
SILVER	MG/KG					0.083 U	14.5 = E	0.24 U	0.18 U	0.2 U	0.05 U	0.22 U
SODIUM	MG/KG					11100 =	7190 =	45700 =	32200 =	38600 =	8900 =	41000 =
THALLIUM	MG/KG					0.45 U	572 =	1.4 J	0.97 U	1.1 U	0.27 U	1.2 U
VANADIUM	MG/KG	169.89				30.5 =	174 =	50.9 =	35 J	40.1 J	23.5 =	45.7 =
ZINC	MG/KG	132.11	124.00	271.00	150.00	26.1 =	**173 = T - E**	67.5 =	60.5 =	59.2 =	12.9 =	53.2 =
Pesticides												
p,p'-DDE	MG/KG					0.0055 U	0.00081 J	0.016 UJ	0.012 UJ	0.013 UJ	0.0083 UJ	0.015 UJ
Volatiles												
CARBON DISULFIDE	MG/KG					0.003 J	0.003 J	0.022 J	0.013 J	0.015 J	0.008 J	0.02 J
METHYL ETHYL KETONE	MG/KG					0.004 J	0.004 J	0.017 J	0.036 R	0.012 J	0.026 R	0.012 J
TOLUENE	MG/KG					0.012 U	0.011 U	0.003 J	0.003 J	0.003 J	0.026 UJ	0.003 J
ETHYLBENZENE	MG/KG					0.012 U	0.011 U	0.002 U	0.001 J	0.002 J	0.026 UJ	0.001 J
M,P-XYLENE	MG/KG					0.0003 J	0.011 U	0.013 J	0.008 J	0.01 J	0.026 UJ	0.005 J
O-XYLENE	MG/KG					0.012 U	0.011 U	0.003 J	0.002 J	0.003 J	0.026 UJ	0.002 J
XYLENES, TOTAL	MG/KG				0.05	0.0003 J	0.011 U	0.016 J	0.01 J	0.013 J	0.026 UJ	0.007 J

Sources:

[1] *Development of an Approach to the Assessment of Sediment Quality in Florida Coastal Waters.*
Volume I - Development and Evaluation of Sediment Quality Assessment Guidelines.
Florida Department of Environmental Protection. November 1994.

[2] National Oceanic and Atmospheric Administration (NOAA) guidelines from *Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments*. E.R. Long et al, 1995

Abbreviations:
PEL - Probable Effects Level
TEL - Threshold Effects Level
ERL - Effects Range - Low

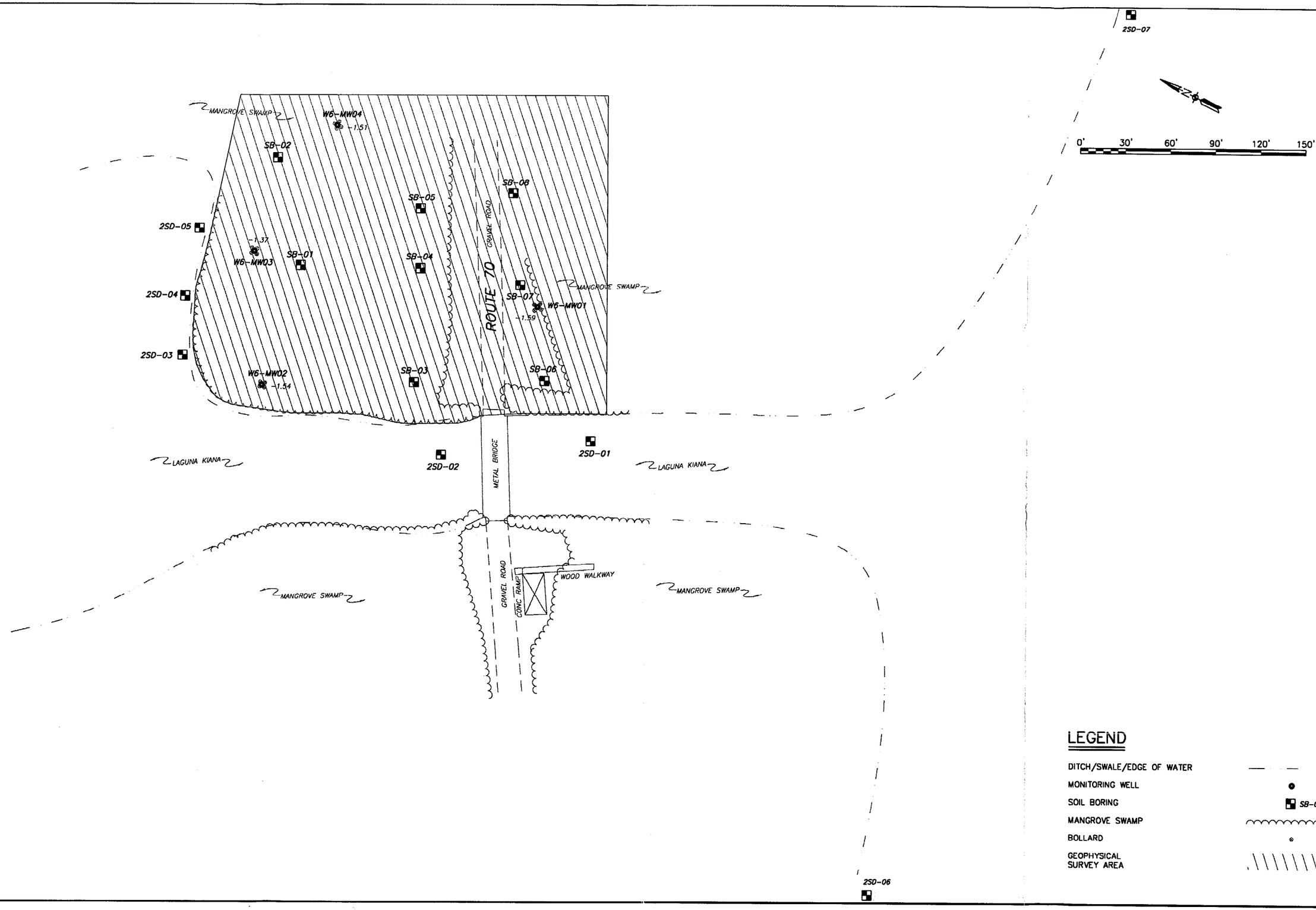

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Figure 5-1 SWMU-6
Sample Locations
Naval Ammunition Support Detachment, Vieques Island

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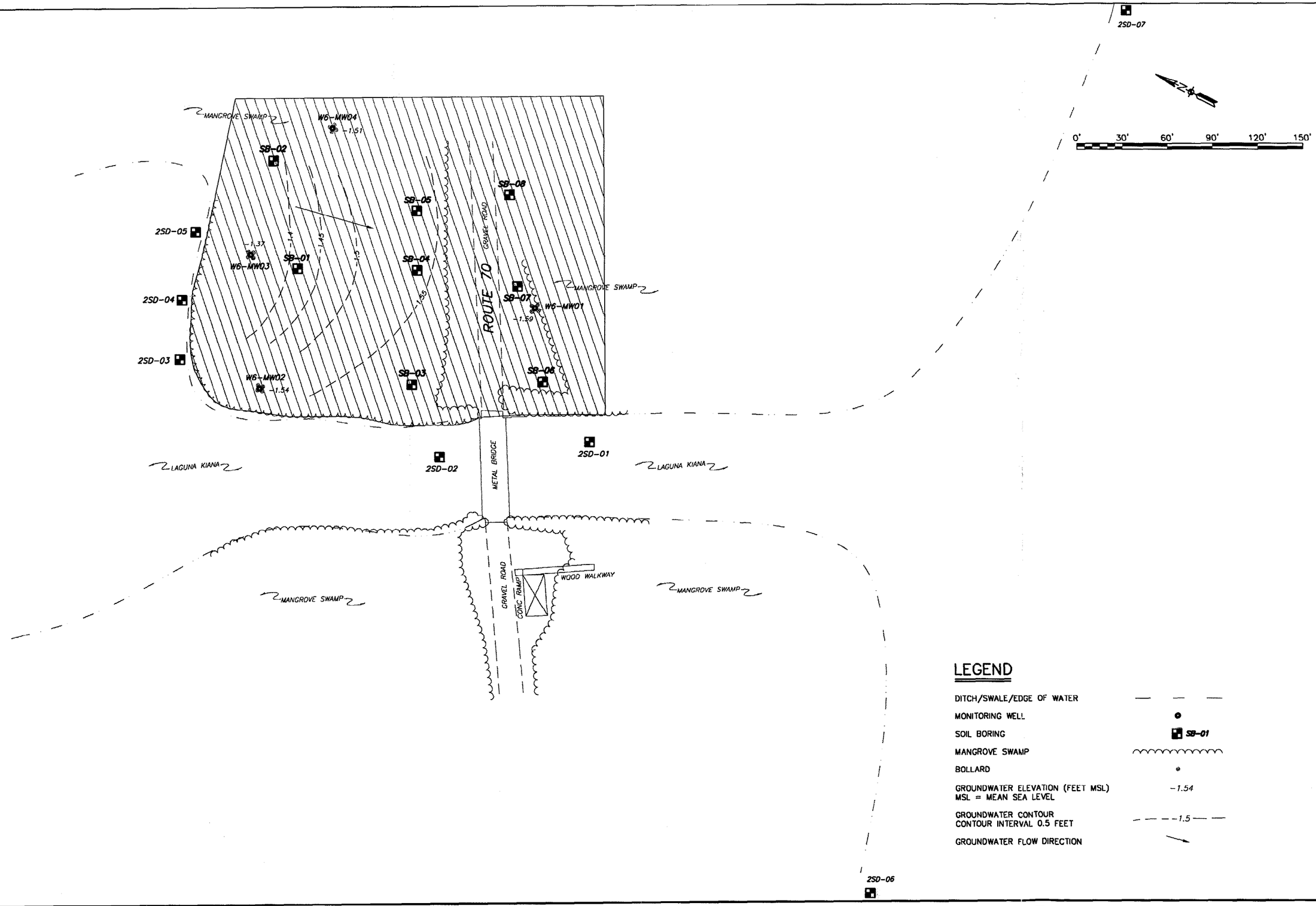

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Figure 5-2 SWMU-6
Groundwater Flow
Naval Ammunition Support Detachment, Vieques Island

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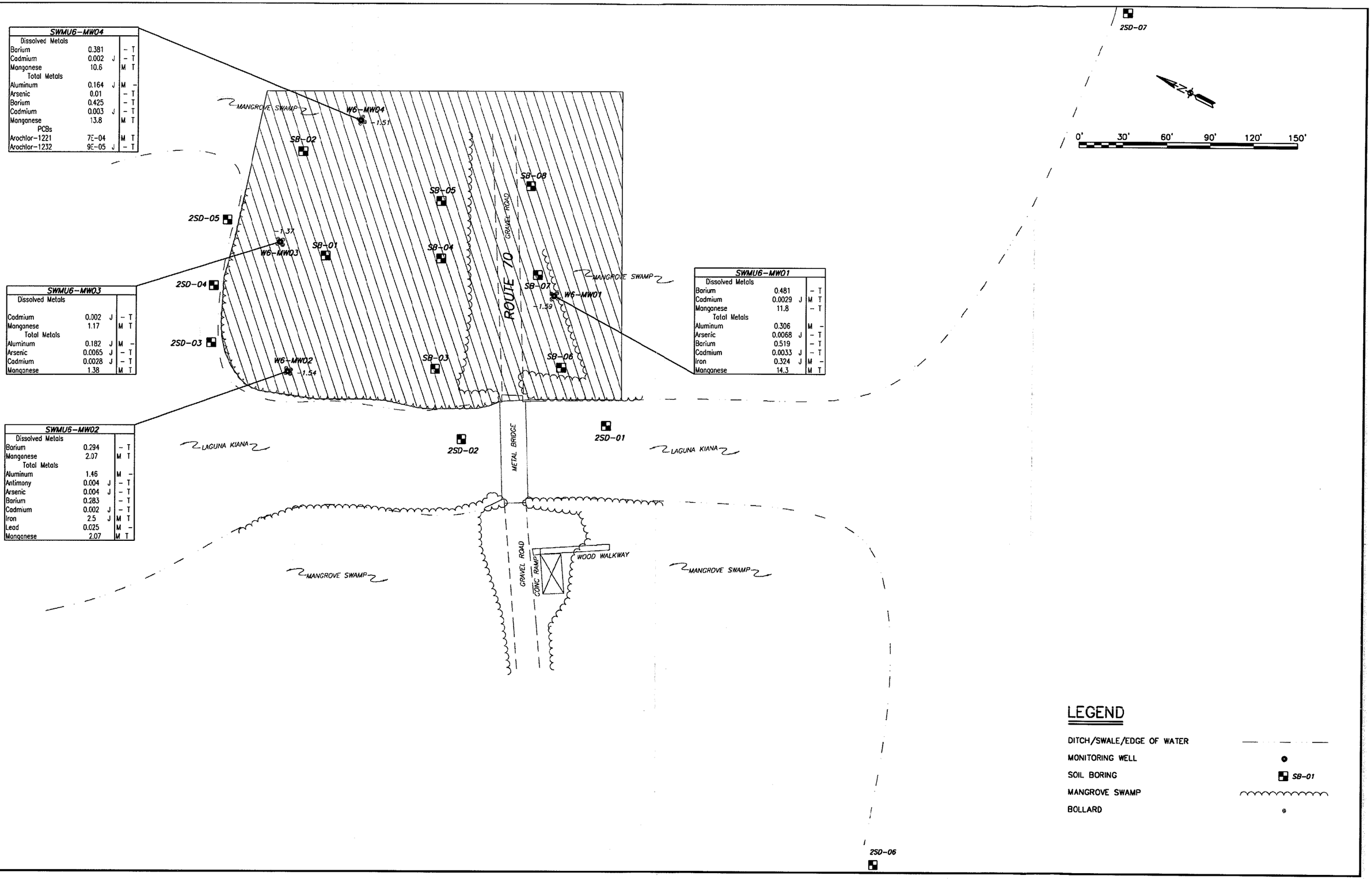

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Figure 5-3 SWMU-6
Groundwater Detections Above Screening Criteria
Naval Ammunition Support Detachment, Vieques Island

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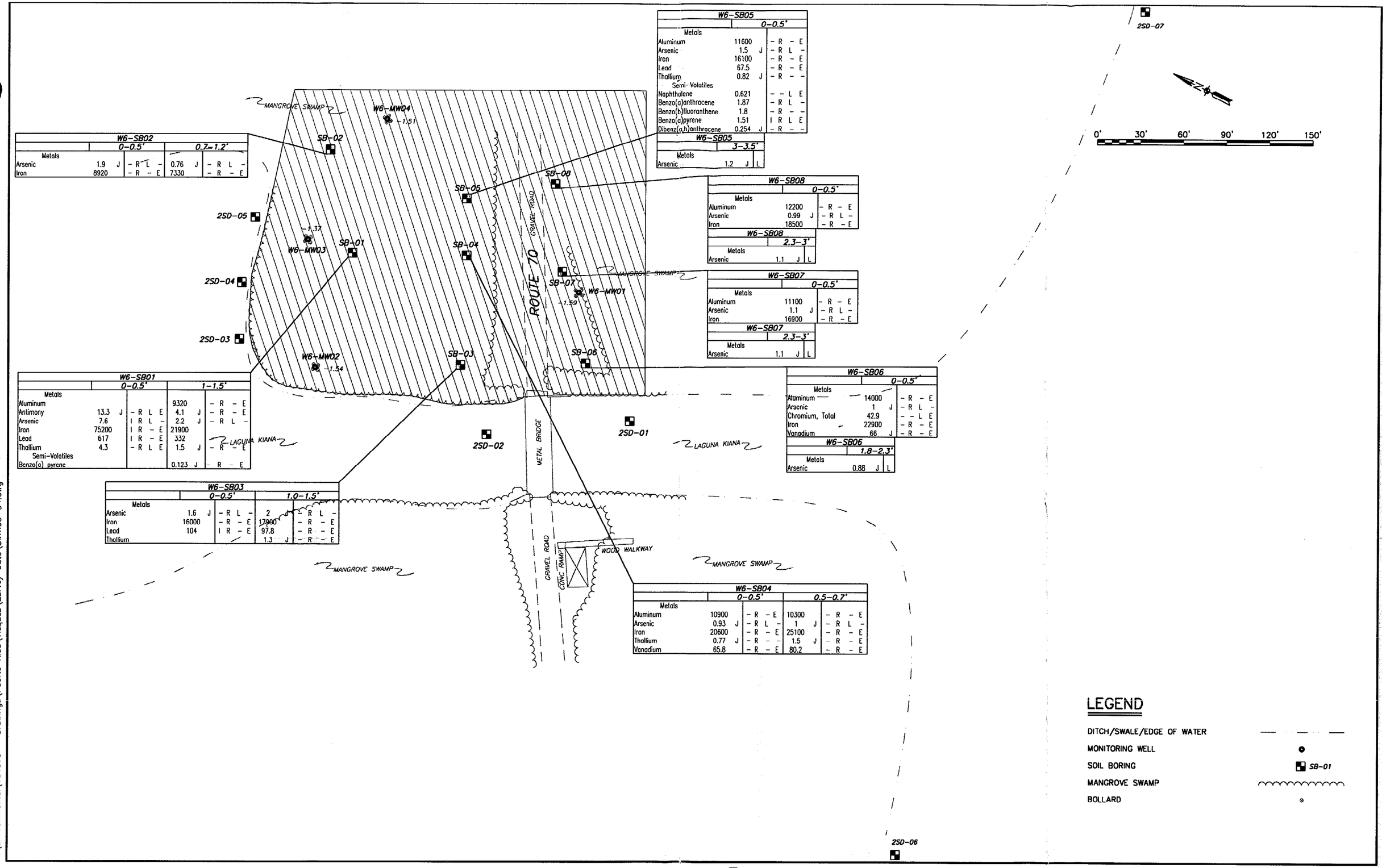

W6-SB02

Metals	0-0.5'			0.7-1.2'		
Arsenic	1.9 J	- R L -		0.76 J	- R L -	
Iron	8920	- R - E		7330	- R - E	

W6-SB05

Metals	0-0.5'		
Aluminum	11600	- R - E	
Arsenic	1.5 J	- R L -	
Iron	16100	- R - E	
Lead	67.5	- R - E	
Thallium	0.82 J	- R - -	
Semi-Volatiles			
Naphthalene	0.621	- - L E	
Benzo(a)anthracene	1.87	- R L -	
Benzo(b)fluoranthene	1.8	- R - -	
Benzo(a)pyrene	1.51	I R L E	
Dibenz(a,h)anthracene	0.254 J	- R - -	

W6-SB05

Metals	3-3.5'	
Arsenic	1.2 J	L

W6-SB08

Metals	0-0.5'	
Aluminum	12200	- R - E
Arsenic	0.99 J	- R L -
Iron	18500	- R - E

W6-SB08

Metals	2.3-3'	
Arsenic	1.1 J	L

W6-SB07

Metals	0-0.5'	
Aluminum	11100	- R - E
Arsenic	1.1 J	- R L -
Iron	16900	- R - E

W6-SB07

Metals	2.3-3'	
Arsenic	1.1 J	L

W6-SB01

Metals	0-0.5'			1-1.5'		
Aluminum				9320		- R - E
Antimony	13.3 J	- R L E		4.1 J		- R - E
Arsenic	7.6	I R L -		2.2 J		- R L -
Iron	75200	I R - E		21900		
Lead	617	I R - E		332		
Thallium	4.3	- R L E		1.5 J		- R - E
Semi-Volatiles						
Benzo(a) pyrene				0.123 J		- R - E

W6-SB06

Metals	0-0.5'	
Aluminum	14000	- R - E
Arsenic	1 J	- R L -
Chromium, Total	42.9	- - L E
Iron	22900	- R - E
Vanadium	66 J	- R - E

W6-SB06

Metals	1.8-2.3'	
Arsenic	0.88 J	L

W6-SB03

Metals	0-0.5'			1.0-1.5'		
Arsenic	1.6 J	- R L -		2		- R L -
Iron	16000	- R - E		17900		- R - E
Lead	104	I R - E		97.8		- R - E
Thallium				1.3 J		- R - E

W6-SB04

Metals	0-0.5'			0.5-0.7'		
Aluminum	10900	- R - E		10300		- R - E
Arsenic	0.93 J	- R L -		1 J		- R L -
Iron	20600	- R - E		25100		- R - E
Thallium	0.77 J	- R - -		1.5 J		- R - E
Vanadium	65.8	- R - E		80.2		- R - E

LEGEND

- DITCH/SWALE/EDGE OF WATER
- MONITORING WELL
- SOIL BORING SB-01
- MANGROVE SWAMP
- BOLLARD

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Figure 5-4 SWMU-6
Soil Detections Above Screening Criteria
Naval Ammunition Support Detachment, Vieques Island

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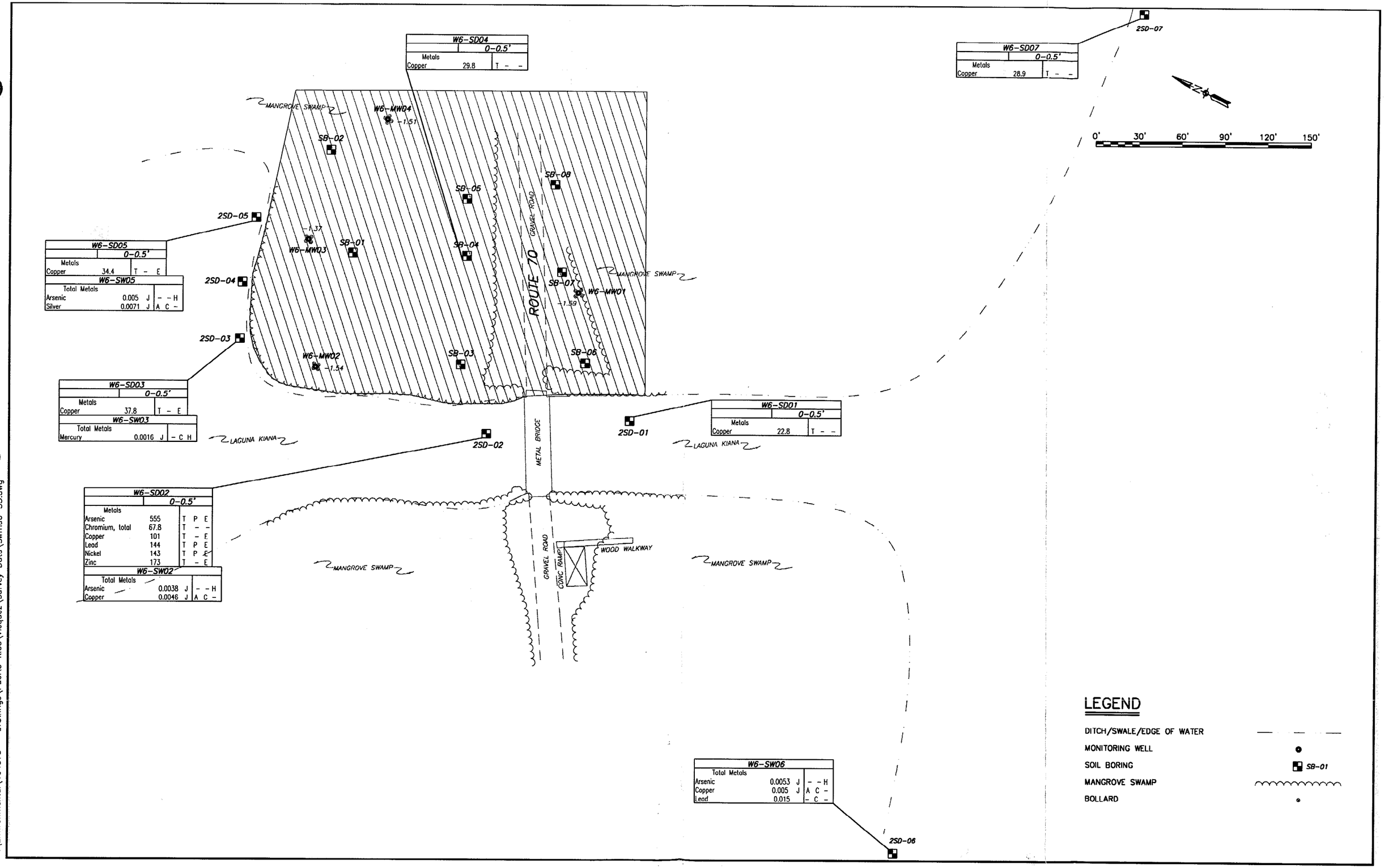

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Figure 5-5 SWMU-6
Surface Water and Sediment Detections Above Screening Criteria
Naval Ammunition Support Detachment, Vieques Island

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TABLE 2-1
SUMMARY OF WELL CONSTRUCTION DETAILS
HYDROGEOLOGICAL INVESTIGATION
VIEQUES ISLAND, PUERTO RICO

Well Number	Date Installed	Top of Casing Elevation (Feet above MSL)	Boring Depth (Ft. bls)	Well Depth (Ft. bls)	PVC Riser (Ft. bls)	Screen Interval Depth (Ft. bls)	Depth to Bentonite (Ft. bls)	Depth to Sandpack (Ft. bls)
SWMU-4-MW-1	4/19/00	25.49	49.0	49.0	39.0	39-49	25.0	27.0
SWMU-4-MW-2	4/20/00	21.99	32.0	51.0	41.0	41-51	37.0	39.0
SWMU-4-MW-3	4/24/00	16.79	41.0	41.0	31.0	31-41	27.0	29.0
SWMU-4-MW-4	4/25/00	7.76	18.0	20.0	10.0	10-20	4.0	6.0
SWMU-4-MW-5	5/31/00	7.58	50.0	40.0	30.0	30-40	26.0	28.0
SWMU-4-MW-6	6/01/00	11.78	45.0	40.0	30.0	30-40	26.0	28.0
SWMU-4-MW-7	6/02/00	14.64	45.0	40.0	30.0	30-40	26.0	28.0
SWMU-4-MW-8	6/02/00	17.60	58.0	50.0	40.0	40-50	36.0	38.0
SWMU-6-MW-1	4/24/00	2.41	15.0	15.0	5.0	5-15	1.0	3.0
SWMU-6-MW-2	4/24/00	3.11	11.0	11.0	1.0	1-11	0.0	0.9
SWMU-6-MW-3	4/25/00	2.25	12.0	12.0	2.0	2-12	0.5	1.33
SWMU-6-MW-4	4/2500	2.46	11.0	11.0	1.0	1-11	0.0	0.5
SWMU-7-MW-2R	4/28/00	69.46	87.0	85.0	75.0	75-85	69.0	71.0
SWMU-7-MW-3R	5/01/00	39.03	58.0	55.0	45.0	45-55	41.0	43.0
SWMU-14-MW-1	4/04/00	47.43	70.0	70.0	60.0	60-70	56.0	58.0
SWMU-14-MW-2	4/05/00	50.93	52.0	50.0	40.0	10-50	36.0	38.0
SWMU-15-MW-1	4/14/00	50.15	53.0	53.0	43.0	43-53	29.0	31.0
AOC-C-MW-1	4/18/00	39.70	46.0	45.0	35.0	35-45	31.0	33.0
AOC-E-MW-4	4/13/00	43.60	51.0	51.0	41.0	41-51	36.0	38.0
AOC-E-MW-5	4/14/00	44.32	51.0	50.0	40.0	40-50	36.0	38.0
AOC-E-MW-6	4/17/00	44.34	46.0	50.0	40.0	40-50	32.0	34.0
AOC-F-MW-1	4/07/00	34.43	53.0	53.0	43.0	43-53	39.0	41.0
AOC-F-MW-2	4/10/00	32.15	52.0	52.0	42.0	42-52	36.0	38.0
AOC-F-MW-3	4/11/00	31.74	45.0	45.0	35.0	35-45	31.0	33.0
AOC-F-MW-4	4/12/00	31.28	52.0	52.0	42.0	42-52	36.0	38.0
AOC-F-MW-5	4/12/00	31.39	47.0	47.0	37.0	37-47	29.0	31.0

Notes:
MSL = Mean Sea Level
bls = below land surface

TABLE 2-2
WELL DEVELOPMENT RECORDS
VIEQUES ISLAND, PUERTO RICO

Well	Development Method	Development Completion Date	Approximate Gallons Developed	Number of Volumes Developed
SWMU-4-MW-1	Surge/Whale Pump	4/27/00	20	10.0
SWMU-4-MW-2	Airlift/Grundfos Pump	4/27/00	35	17.5
SWMU-4-MW-3	Airlift/Grundfos Pump	4/28/00	45	11.3
SWMU-4-MW-4	Airlift/Grundfos Pump	4/28/00	25	12.5
SWMU-4-MW-5	Swab/Grunfos Pump	6/3/00	55	9.8
SWMU-4-MW-6	Swab/Grunfos Pump	6/4/00	110	22.9
SWMU-4-MW-7	Swab/Grunfos Pump	6/4/00	55	12.7
SWMU-4-MW-8	Swab/Grunfos Pump	6/5/00	45	8.8
SWMU-6-MW-1	Peristaltic Pump	4/24/00	10	4.8
SWMU-6-MW-2	Peristaltic Pump	4/24/00	8	5.0
SWMU-6-MW-3	Peristaltic Pump	4/25/00	8	4.6
SWMU-6-MW-4	Peristaltic Pump	4/25/00	11	7.2
SWMU-7-MW-2R	Grunfos Pump	5/1/00	38	14.2
SWMU-7-MW-3R	Grunfos Pump	5/1/00	40	13.5
SWMU-14-MW-1	Surge/Whale Pump	4/27/00	50	11.1
SWMU-14-MW-2	Surge/Whale Pump	4/26/00	9	6.0
SWMU-15-MW-1	Surge/Whale Pump	4/25/00	35	53.5
AOC-C-MW-1	Surge/Grunfos Pump	4/25/00	36	20.5
AOC-E-MW-4	Surge/Whale Pump	4/26/00	18	7.8
AOC-E-MW-5	Surge/Whale Pump	4/27/00	8	4.1
AOC-E-MW-6	Surge/Whale Pump	4/26/00	36	24.0
AOC-F-MW-1	Surge/Grundfos Pump	4/17/00	80	22.2
AOC-F-MW-2	Surge/Grundfos Pump	4/18/00	56	14.0
AOC-F-MW-3	Surge/Grundfos Pump	4/19/00	56	18.7
AOC-F-MW-4	Surge/Grunfos Pump	4/19/00	55	13.8
AOC-F-MW-5	Surge/Grunfos Pump	4/18/00	68	22.3

TABLE 2-3
WATER LEVEL MEASUREMENTS
VIEQUES ISLAND, PUERTO RICO

Well No.	Date	Elevation (feet msl)	Depth to Water (feet)	Groundwater Level (feet msl)
S-4-MW1	8/18/00	25.49	27.5	-2.01
S-4-MW2	8/18/00	21.99	22.85	-0.86
S-4-MW3	8/18/00	16.79	17.78	-0.99
S-4-MW4	8/18/00	7.76	8.35	-0.59
S-4-MW5	8/18/00	7.58	9.09	-1.51
S-4-MW6	8/18/00	11.78	11.48	0.3
S-4-MW7	8/18/00	14.64	14.94	-0.3
S-4-MW8	8/18/00	17.6	18.52	-0.92
S-6-MW1	5/3/00	2.41	4	-1.59
S-6-MW2	5/3/00	3.11	4.65	-1.54
S-6-MW3	5/3/00	2.25	3.62	-1.37
S-6-MW4	5/3/00	2.46	3.97	-1.51
S-7-MW1	5/3/00	41.72	40.16	1.56
S-7-MW2	5/3/00	69.46	68.15	1.31
S-7-MW3	5/3/00	39.03	39.2	-0.17
S14-MW1	5/3/00	50.93	43.46	7.47
S14-MW2	5/3/00	47.43	40.28	7.15
S15-MW1	5/3/00	50.15	39.58	10.57
A-C-MW1	5/3/00	39.7	34.28	5.42
A-E-MW1	5/3/00	43.93	38.39	5.54
A-E-MW2	5/3/00	42.68	37.28	5.4
A-E-MW3	5/3/00	44.06	37.72	6.34
A-E-MW4	5/3/00	43.6	37.36	6.24
A-E-MW5	5/3/00	44.32	38.05	6.27
A-E-MW6	5/3/00	44.34	38.1	6.24
A-F-MW1	5/3/00	34.43	30.78	3.65
A-F-MW2	5/3/00	32.15	29.02	3.13
A-F-MW3	5/3/00	31.74	28.5	3.24
A-F-MW4	5/3/00	31.28	28.25	3.03
A-F-MW5	5/3/00	31.39	28.3	3.09

TABLE 2-4
SURVEY DATA
VIEQUES ISLAND, PUERTO RICO

SWMU-4			
STATION	LATITUDE	LONGITUDE	ELEVATION
W4-MW01	18^ 06' 02.007206" N	65^ 34' 15.105179" W	25.49'
W4-MW02	18^ 05' 59.851196" N	65^ 34' 13.137493" W	21.99'
W4-MW03	18^ 05' 57.783599" N	65^ 34' 14.906479" W	16.79'
W4-MW04	18^ 05' 56.437920" N	65^ 34' 15.410537" W	7.76'
SB-1	18^ 05' 59.882892" N	65^ 34' 14.357105" W	20.72'
SB-2	18^ 05' 59.786523" N	65^ 34' 14.036138" W	20.36'
SB-3	18^ 05' 59.722386" N	65^ 34' 13.755749" W	18.83'
SB-4	18^ 05' 57.966236" N	65^ 34' 15.347900" W	17.88'
SB-5	18^ 05' 57.900362" N	65^ 34' 15.170411" W	15.52'
SB-6	18^ 05' 57.758101" N	65^ 34' 14.861739" W	14.03'
SB-7	18^ 05' 56.735863" N	65^ 34' 15.708978" W	8.62'
SB-8	18^ 05' 56.653220" N	65^ 34' 15.463228" W	5.59'
SB-9	18^ 05' 56.398786" N	65^ 34' 15.183961" W	4.52'
SB-10	18^ 05' 56.227888" N	65^ 34' 14.977517" W	4.84'
SB-11	18^ 06' 02.142753" N	65^ 34' 14.728551" W	22.51'
SB-12	18^ 06' 02.182947" N	65^ 34' 14.375163" W	22.97'

SWMU-5			
STATION	LATITUDE	LONGITUDE	ELEVATION
W5-SB01	18 06 03.170	65 32 21.919	111.24
W5-SB02	18 06 03.093	65 32 21.983	109.86
W5-SB03	18 06 03.023	65 32 22.034	109.90
W5-SB04	18 06 02.947	65 32 22.096	109.75

SWMU-6			
STATION	LATITUDE	LONGITUDE	ELEVATION
SWMU-6-MW01	18^ 07' 02.368650" N	65^ 33' 40.790472" W	2.41'
SWMU-6-MW02	18^ 07' 03.782243" N	65^ 33' 42.117861" W	3.11'
SWMU-6-MW03	18^ 07' 04.216331" N	65^ 33' 41.318848" W	2.25'
SWMU-6-MW04	18^ 07' 04.087294" N	65^ 33' 40.293935" W	2.46'
2SB-01	18^ 07' 03.897884" N	65^ 33' 41.262330" W	-1.38'
2SB-02	18^ 07' 04.348666" N	65^ 33' 40.673820" W	-1.43'
2SB-03	18^ 07' 02.882766" N	65^ 33' 41.633897" W	-0.22'
2SB-04	18^ 07' 03.178419" N	65^ 33' 40.913497" W	-0.88'
2SB-05	18^ 07' 03.349855" N	65^ 33' 40.547464" W	-1.25'
2SB-06	18^ 07' 02.111360" N	65^ 33' 41.223423" W	0.25'
2SB-07	18^ 07' 02.533890" N	65^ 33' 40.710841" W	-0.11'

TABLE 2-4
SURVEY DATA
VIEQUES ISLAND, PUERTO RICO

2SB-08	18^ 07' 02.844313" N	65^ 33' 40.169921" W	-0.54'
2SE-01	18^ 07' 01.663237" N	65^ 33' 41.450429" W	-4.72'
2SE-02	18^ 07' 02.512434" N	65^ 33' 41.994799" W	-3.98'
2SE-03	18^ 07' 04.338842" N	65^ 33' 42.178483" W	-4.10'
2SE-04	18^ 07' 04.495766" N	65^ 33' 41.807115" W	-3.90'
2SE-05	18^ 07' 04.609965" N	65^ 33' 41.346993" W	-3.53'
2SE-06	18^ 06' 58.669199" N	65^ 33' 43.519537" W	-4.72'
2SE-07	18^ 06' 59.713631" N	65^ 33' 37.172966" W	-4.58'

SWMU-7			
STATION	**LATITUDE**	**LONGITUDE**	**ELEVATION**
SB-01	18^ 07' 02.325536" N	65^ 32' 09.800283" W	76.34'
SB-02	18^ 07' 02.174624" N	65^ 32' 09.863476" W	64.92'
SB-03	18^ 07' 03.094542" N	65^ 32' 10.752333" W	61.46'
SB-04	18^ 07' 03.005450" N	65^ 32' 10.895420" W	52.22'
SB-05	18^ 07' 04.175940" N	65^ 32' 11.252262" W	57.84'
SB-06	18^ 07' 04.211148" N	65^ 32' 11.490527" W	47.57'
W7-SD01	18^ 07' 02.038613" N	65^ 32' 09.733123" W	61.57'
W7-SD02	18^ 07' 04.254503" N	65^ 32' 11.651686" W	38.53'
W7-SD03	18^ 07' 10.131205" N	65^ 32' 16.777682" W	21.25'
W7-MW01	18^ 07' 10.074963" N	65^ 32' 13.903800" W	41.72'
W7-MW02R	18^ 07' 04.363658" N	65^ 32' 10.940662" W	69.46'
W7-MW03R	18^ 07' 10.100450" N	65^ 32' 16.127643" W	39.03'

SWMU10			
STATION	**LATITUDE**	**LONGITUDE**	**ELEVATION**
SB-01	18^ 07' 25.258609" N	65^ 31' 27.102147" W	43.51
SB-02	18^ 07' 25.395983" N	65^ 31' 27.083862" W	43.03
SB-03	18^ 07' 25.492094" N	65^ 31' 27.146321" W	42.92
SB-04	18^ 07' 25.596499" N	65^ 31' 27.223644" W	42.29
SB-05	18^ 07' 25.588500" N	65^ 31' 27.341036" W	42.43
SB-06	18^ 07' 25.515968" N	65^ 31' 27.437390" W	42.53
SB-07	18^ 07' 25.410057" N	65^ 31' 27.387372" W	42.63
SB-08	18^ 07' 25.331607" N	65^ 31' 27.371505" W	42.81
SB-09	18^ 07' 25.276376" N	65^ 31' 27.291099" W	42.87
SB-10	18^ 07' 25.233870" N	65^ 31' 27.206710" W	43.23

TABLE 2-4
SURVEY DATA
VIEQUES ISLAND, PUERTO RICO

SWMU14			
STATION	**LATITUDE**	**LONGITUDE**	**ELEVATION**
SB-01	18^ 07' 23.652861" N	65^ 31' 30.271335" W	46.71
SB-02	18^ 07' 23.873976" N	65^ 31' 30.370409" W	46.30
SB-03	18^ 07' 24.051616" N	65^ 31' 30.460209" W	45.70
SB-04	18^ 07' 24.200800" N	65^ 31' 30.548663" W	44.95
SB-05	18^ 07' 24.272879" N	65^ 31' 30.542406" W	44.56
SB-06	18^ 07' 24.132197" N	65^ 31' 30.748760" W	45.94
SB-07	18^ 07' 23.969771" N	65^ 31' 30.678026" W	47.35
SB-08	18^ 07' 24.418349" N	65^ 31' 31.104540" W	43.95
SB-09	18^ 07' 24.204518" N	65^ 31' 30.884437" W	42.68
SB-10	18^ 07' 24.044689" N	65^ 31' 30.874072" W	47.48
SB-11	18^ 07' 23.923885" N	65^ 31' 30.818929" W	47.48
SB-12	18^ 07' 23.699982" N	65^ 31' 30.533995" W	47.68
SB-13	18^ 07' 23.785636" N	65^ 31' 30.614865" W	47.83
W14-MW01	18^ 07' 24.517886" N	65^ 31' 31.209748" W	47.43
W14-MW02	18^ 07' 22.409306" N	65^ 31' 30.140281" W	50.93

SWMU15			
STATION	**LATITUDE**	**LONGITUDE**	**ELEVATION**
SB-01	18^ 07' 23.355528" N	65^ 31' 30.457697" W	49.01
SB-02	18^ 07' 23.677040" N	65^ 31' 30.639962" W	48.36
SB-03	18^ 07' 23.980215" N	65^ 31' 30.866033" W	47.15
SB-04	18^ 07' 24.247323" N	65^ 31' 31.102129" W	46.07
SB-05	18^ 07' 24.469171" N	65^ 31' 31.314559" W	44.80
SB-06	18^ 07' 24.066870" N	65^ 31' 31.585598" W	46.38
SB-07	18^ 07' 23.825763" N	65^ 31' 31.455551" W	47.30
SB-08	18^ 07' 23.497436" N	65^ 31' 31.299481" W	48.37
SB-09	18^ 07' 23.150251" N	65^ 31' 31.175805" W	49.54
SB-10	18^ 07' 22.986715" N	65^ 31' 31.496083" W	50.19
SB-11	18^ 07' 23.322996" N	65^ 31' 31.648936" W	48.85
SB-12	18^ 07' 23.689588" N	65^ 31' 31.813734" W	47.34
SB-13	18^ 07' 23.159582" N	65^ 31' 32.032398" W	49.31
SB-14	18^ 07' 22.862210" N	65^ 31' 31.837804" W	50.25
SB-15	18^ 07' 22.829143" N	65^ 31' 32.248437" W	50.20
SB-16	18^ 07' 22.638750" N	65^ 31' 32.410534" W	50.15
W15-MW01	18^ 07' 22.638750" N	65^ 31' 32.410534" W	50.15

TABLE 2-4
SURVEY DATA
VIEQUES ISLAND, PUERTO RICO

AOC-C			
STATION	LATITUDE	LONGITUDE	ELEVATION
SB-01	18^ 07' 27.470401" N	65^ 31' 29.556136" W	32.39
SB-02	18^ 07' 28.423657" N	65^ 31' 29.893709" W	28.79
SB-03	18^ 07' 29.616515" N	65^ 31' 30.367937" W	26.51
SB-04	18^ 07' 30.820604" N	65^ 31' 30.816377" W	23.61
SB-05	18^ 07' 32.003382" N	65^ 31' 31.278235" W	20.08
SB-06	18^ 07' 33.132809" N	65^ 31' 31.614726" W	17.63
SB-07	18^ 07' 34.383735" N	65^ 31' 31.896048" W	13.51
SB-08	18^ 07' 27.454541" N	65^ 31' 30.078434" W	32.97
SB-09	18^ 07' 28.364766" N	65^ 31' 30.425854" W	30.05
SB-10	18^ 07' 29.409342" N	65^ 31' 30.889486" W	26.85
SB-11	18^ 07' 30.536538" N	65^ 31' 31.356842" W	23.89
SB-12	18^ 07' 31.682530" N	65^ 31' 31.755462" W	21.74
SB-13	18^ 07' 32.858993" N	65^ 31' 32.253399" W	19.57
SB-14	18^ 07' 34.042010" N	65^ 31' 32.677087" W	15.86
SB-15	18^ 07' 34.979152" N	65^ 31' 32.159395" W	9.51
SB-16	18^ 07' 25.683458" N	65^ 31' 29.910251" W	41.72
SB-17	18^ 07' 25.764978" N	65^ 31' 29.985634" W	41.68
SB-18	18^ 07' 25.814501" N	65^ 31' 29.838493" W	41.34
SB-19	18^ 07' 25.899174" N	65^ 31' 29.999750" W	40.68
AC-MW01	18^ 07' 25.982911" N	65^ 31' 29.893693" W	39.70

AOC-E			
STATION	LATITUDE	LONGITUDE	ELEVATION
AE-MWE01	18^ 07' 24.702237" N	65^ 31' 30.539691" W	43.93'
AE-MWE02	18^ 07' 25.246643" N	65^ 31' 30.794733" W	42.68'
AE-MWE03	18^ 07' 24.538020" N	65^ 31' 30.459919" W	44.06'
AE-MWE04	18^ 07' 24.773106" N	65^ 31' 30.684290" W	43.60'
AE-MWE05	18^ 07' 24.785336" N	65^ 31' 30.508099" W	44.32'
AE-MWE06	18^ 07' 24.931917" N	65^ 31' 30.158582" W	44.34'

AOC-F			
STATION	LATITUDE	LONGITUDE	ELEVATION
SB-01	18^ 07' 27.731018" N	65^ 31' 32.883056" W	33.52
SB-02	18^ 07' 27.564603" N	65^ 31' 33.001865" W	33.96
SB-03	18^ 07' 27.641145" N	65^ 31' 33.111438" W	34.06
SB-04	18^ 07' 27.738325" N	65^ 31' 33.049773" W	33.01
AF-MW01	18^ 07' 27.365361" N	65^ 31' 32.977782" W	34.43
AF-MW02	18^ 07' 27.905862" N	65^ 31' 33.187283" W	32.15
AF-MW03	18^ 07' 27.855278" N	65^ 31' 33.514335" W	31.74
AF-MW04	18^ 07' 25.291943" N	65^ 31' 31.072152" W	31.28
AF-MW05	18^ 07' 28.133689" N	65^ 31' 33.219063" W	31.39

TABLE 2-5
Federally Listed Species Potentially Occurring at NASD, Vieques
NASD, Vieques Island, Puerto Rico

Scientific Name	Common Name	Federal Status
Plants		
Chamaecrista glandulosa var. *mirabilis* (Herb)	Jamaican broom	Endangered
Stahlia monosperma	Cobana negra	Threatened
Calyptranthes thomasiana	Thomas' lidflower	Endangered
Eugenia woodburyana	Woodbury's stopper	Endangered
Reptiles and Amphibians		
Chelonia mydas	Green sea turtle	Threatened
Dermochelys coriacea	Leatherback sea turtle	Endangered
Eretmochelys imbricata	Hawksbill sea turtle	Endangered
Birds		
Falco peregrinus tundrius	Arctic peregrine falcon	Threatened
Pelecanus occidentalis occidentalis	Brown pelican	Endangered
Sterna dougalli dougalli	Roseate tern	Endangered
Mammals		
Physeter macrocephalus	Sperm whale	Endangered
Balaenoptera physalus	Fin whale	Endangered
Megaptera novaeangliae	Humpback whale	Endangered
Trichechas manatus	West Indian manatee	Endangered

Source: NASD, 1996

Table 3-1
Groundwater Analytical Data Summary
SWMU 4, NASD - Vieques, PR

StationID					SWMU4-MW01	SWMU4-MW02	SWMU4-MW03	SWMU4-MW04	SWMU4-MW05	SWMU4-MW06	SWMU4-MW07	SWMU4-MW08
SampleID					NDA001	NDA003	NDA004	NDA002	NDB010	NDB011	NDB013	NDB014
Date Collected		Screening Criteria			04/28/2000 9:10	04/27/2000 14:45	04/27/2000 14:00	04/27/2000 11:40	06/12/2000 15:00	06/12/2000 11:00	06/12/2000 15:20	06/12/2000 11:45
Paramater Name	Units	BKG	Federal MCL (M)	Tapwater RBC (T)								
Dissolved Metals												
ALUMINUM, DISSOLVED	MG/L		0.05	3.65	0.0278 J	0.0258 U	0.0258 U	0.0258 U	38.3 J MT	42.4 J MT	28 J MT	25.8 U
BARIUM, DISSOLVED	MG/L	0.28	2.00	0.255	0.445 = - T	0.257 = - T	0.6 = - T	0.904 = - T	193 J M T	335 = M T	238 = M T	838 = M T
CALCIUM, DISSOLVED	MG/L				450 =	96.8 J	1050 J	1020 J	804000 R	692000 R	910000 R	100000 =
CADMIUM, DISSOLVED	MG/L	0.0040	0.0050	0.0018	0.0022 J - T	0.00025 J - T	0.0035 J - T	0.0043 J - T	0.2 U	0.2 U	0.2 U	0.2 U
CHROMIUM, DISSOLVED	MG/L	0.02	0.10	0.11	0.004 J	0.00083 J	0.0019 J	0.0011 J	0.5 U	0.5 U	0.5 U	1.6 J M T
COPPER, DISSOLVED	MG/L	0.04	1.00	0.15	0.0019 U	0.0055 J	0.0044 J	0.0041 J	3.3 J MT	3.2 J MT	2.9 J MT	3 J MT
IRON, DISSOLVED	MG/L		0.30	1.10	0.0122 J	0.0122 U	0.0122 U	0.0122 U	12.2 U	12.2 U	12.2 U	12.2 U
LEAD, DISSOLVED	MG/L		0.01		0.0011 U	0.0034 =	0.004 =	0.0052 =	1.1 U	1.1 U	1.1 U	1.1 U
MAGNESIUM, DISSOLVED	MG/L				527 =	50.8 =	727 =	712 =	488000 =	476000 =	666000 R	137000 =
MANGANESE, DISSOLVED	MG/L		0.05	0.07	0.0326 =	0.535 = M T	0.131 =	1.44 = M T	1750 = MT	1040 = MT	2700 = MT	7210 = MT
MERCURY, DISSOLVED	MG/L		0.0020	0.0011	0.00018 U	0.00018 U	0.00028 =	0.00018 U	0.18 U	0.18 U	0.18 U	0.18 U
NICKEL, DISSOLVED	MG/L	0.02	0.10	0.07	0.0061 J	0.0008 U	0.0031 J	0.0019 J	3.8 J MT	3.8 J MT	5.9 J MT	6.4 J MT
POTASSIUM, DISSOLVED	MG/L				12.5 J	6.56 J	18.8 J	29.8 J	28600 J	16800 J	14900 J	10500 J
SELENIUM, DISSOLVED	MG/L	0.02	0.05	0.02	0.0068 =	0.0021 U	0.0041 J	0.0021 U	2.1 U	2.1 U	2.1 U	2.9 J MT
SILVER, DISSOLVED	MG/L		0.10	0.02	0.0005 U	0.0005 U	0.00053 J	0.0005 U	0.61 J MT	0.5 U	0.5 U	0.5 U
SODIUM, DISSOLVED	MG/L				3070 J	1040 J	3460 J	1830 J	4140000 R	2950000 R	1980000 R	1650000 R
VANADIUM, DISSOLVED	MG/L	0.04		0.03	0.0047 J	0.0121 J	0.0042 J	0.0037 J	3.8 J MT	4.4 J MT	3.3 J MT	5 J MT
ZINC, DISSOLVED	MG/L	0.14	5.00	1.10	0.0308 =	0.0109 J	0.0081 J	0.0088 J	2.5 U	2.5 U	2.5 U	2.5 U
Total Metals												
ALUMINUM	MG/L		0.05	3.65	2.9 J M -	0.635 J M -	1.65 J M -	5.42 J M T	219 J MT	1770 J MT	7700 J MT	8580 J MT
BARIUM	MG/L	0.28	2.00	0.26	0.486 = - T	0.28 = - T	0.671 = - T	0.943 = - T	219 = MT	407 = MT	404 = MT	952 = MT
CADMIUM	MG/L	0.0040	0.0050	0.0018	0.002 J - T	0.00038 J	0.0036 J - T	0.0046 J - T	0.2 U	0.2 U	0.2 U	0.2 U
CALCIUM	MG/L				435 =	103 J	1090 J	1020 J	831000 R	694000 R	915000 R	98700 =
CHROMIUM, TOTAL	MG/L	0.02	0.10	0.11	0.0147 =	0.0014 J	0.0049 J	0.0036 J	0.55 J MT	1.1 J MT	2 J MT	3.8 J MT
COBALT	MG/L	0.02		0.22	0.0005 U	0.00056 J	0.00052 J	0.0035 J	1.9 J	2.1 J	8.8 J	9.8 J
COPPER	MG/L	0.04	1.00	0.15	0.0033 J	0.0047 J	0.0042 J	0.0108 J	4.4 J	4.7 J	8.9 J	123 =
IRON	MG/L		0.30	1.10	1.83 J M T	0.488 = M -	1.23 = M T	4.6 = M T	86.1 J	1480 J	7090 J	8080 J
LEAD	MG/L		0.01		0.0018 J	0.002 J	0.0042 =	0.0067 =	1.1 U	1.8 J	2.7 J	7.6 =
MAGNESIUM	MG/L				510 =	52 =	751 =	697 =	551000 R	481000 J	672000 R	133000 =
MANGANESE	MG/L		0.05	0.07	0.154 = M T	0.56 = M T	0.217 = M T	1.68 = M T	1920 =	1260 =	3170 =	7380 =
MERCURY	MG/L		0.0020	0.0011	0.00018 U	0.00018 U	0.00018 U	0.00018 U	0.18 U	0.18 U	0.18 U	0.18 U
NICKEL	MG/L	0.02	0.10	0.07	0.0118 J	0.001 J	0.0048 J	0.0038 J	3.3 J MT	4.2 J MT	7.2 J MT	8.1 J MT
POTASSIUM	MG/L				14.4 J	6.99 J	20.1 J	30 J	30000 J	17800 J	16600 J	11600 J
SELENIUM	MG/L	0.02	0.05	0.02	0.0054 =	0.0021 U	0.0037 J	0.0048 J	2.1 U	2.1 U	2.4 J MT	2.9 J MT
SILVER	MG/L		0.10	0.02	0.0005 U	0.0005 U	0.0005 U	0.00065 J	0.61 J MT	0.82 J MT	0.5 U	0.5 U
SODIUM	MG/L				3090 J	1040 J	3550 J	1810 J	4210000 R	2970000 R	2020000 R	1630000 R
VANADIUM	MG/L	0.04		0.03	0.0093 J	0.0142 J	0.0075 J	0.0157 J	3.9 J MT	7.2 J MT	21.4 J MT	24.9 J MT
ZINC	MG/L	0.14	5.00	1.10	0.0384 =	0.0081 J	0.0185 J	0.0395 =	2.5 U	2.5 U	29.3 = MT	36.7 = MT
Miscellaneous												
PERCHLORATE	MG/L					0.02 =	0.016 U	0.016 U	8 U	8 U	8 U	8 U
Pesticides												
DELTA BHC (DELTA HEXACHLOROCYCLOHEXAN	MG/L			0.000037	0.00001 U	0.00001 U	0.00001 U	0.00001 J	0.01 UJ	0.01 UJ	0.01 UJ	0.01 UJ
Semi-Volatiles												
DIETHYL PHTHALATE	MG/L			29.00	0.005 U	0.002 J	0.005 U	0.006 U	6 U	6 U		
bis(2-ETHYLHEXYL) PHTHALATE	MG/L			0.005	0.003 J	0.007 U	0.005 U	0.006 U	6 U	6 U		

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Table 3-2
Surface Soil Analytical Data Summary
SWMU-04, NASD - Vieques, PR

StationID						SWMU4-MW05	SWMU4-MW06	SWMU4-MW07	SWMU4-MW08	W4-SB01	W4-SB02	W4-SB03	W4-SB04
SampleID						NDB001	NDB003	NDB006	NDB008	NDA057	NDA059	NDA061	NDA065
Collection Depth			Industrial	Residential		0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5
Date Collected			RBC	RBC	SSL	06/06/2000 10:50	06/06/2000 11:15	06/06/2000 13:30	06/06/2000 10:00	04/18/2000 9:45	04/18/2000 10:10	04/18/2000 10:45	04/18/2000 14:00
Parameter	Units	BKG	(I)	RBC-R (R)	(L)								
Explosives													
2,6-DINITROTOLUENE	MG/KG			7.80	0.25	0.511 U	0.468 U	0.427 U	0.427 U	0.563 UJ	0.127 J	0.469 UJ	0.421 UJ
OCTAHYDRO-1,3,5,7-TETRANITRO-1,3,5,7-TETRAZOCINE	MG/KG			390.00		0.261 U	0.26 U	0.257 U	0.246 U	0.306 U	0.261 U	0.259 U	0.309 U
HEXAHYDRO-1,3,5-TRINITRO-1,3,5,7-TETRAZOCINE	MG/KG			5.80	0.01	0.261 U	0.26 U	0.257 U	0.246 U	0.306 U	0.261 U	0.259 U	0.309 U
2,4,6-TRINITROTOLUENE	MG/KG			21.00	0.06	0.261 U	0.26 U	0.257 U	0.246 U	0.306 U	0.261 U	0.259 U	0.309 U
Metals													
ALUMINUM	MG/KG		204400.00	7821.43		3350 =	2800 =	2640 =	3890 =	4580 J	4040 J	4920 J	**11700 = - R -**
ARSENIC	MG/KG	2.08	3.82	0.43	0.03	**0.83 J - R L**	**0.81 J - R L**	**0.57 J - R L**	**0.9 J - R L**	**0.88 J - R L**	**0.92 J - R L**	**0.8 J - R L**	**1.3 J - R L**
BARIUM	MG/KG	167.17	14308.00	547.50	2105.32	78.8 =	36.3 J	48.9 =	69.2 =	219 R	315 R	150 R	274 J
BERYLLIUM	MG/KG	0.58	408.80	15.64	1153.69	0.24 J	0.19 J	0.13 J	0.25 J	0.21 J	0.2 J	0.19 J	0.54 J
CADMIUM	MG/KG	0.35	102.20	3.91	27.45	0.028 J	0.021 U	0.021 U	0.022 J	0.032 J	0.32 J	0.021 U	0.025 U
CALCIUM	MG/KG					784 J	440 J	586 J	693 J	708 J	833 J	1020 J	1060 J
CHROMIUM, TOTAL	MG/KG	45.92	450.00	210.00	40.00	1.4 J	1.4 J	1.4 J	1.6 J	2.3 J	2.5 =	2.3 =	3.3 =
COBALT	MG/KG	39.41	12264.00	469.29		3.2 J	1.8 J	1.8 J	3 J	3.3 J	3.7 J	3.2 J	3.3 J
COPPER	MG/KG	147.78	8176.00	312.86	10517.84	6.2 =	2.1 J	2.9 J	10 =	10.7 =	38.4 =	7.3 =	1.9 J
IRON	MG/KG	9360.00	61320.00	2346.43		**6990 = - R -**	**5450 = - R -**	**4580 = - R -**	**7820 = - R -**	**6670 J - R -**	**7120 J - R -**	**6170 J - R -**	**16000 = - R -**
LEAD	MG/KG	4.19	100.00	40.00		10 =	4.9 =	5.2 =	8.2 =	12 J	20.1 J	11 J	8.2 =
MAGNESIUM	MG/KG					414 J	258 J	273 J	527 J	414 J	440 J	540 J	1040 J
MANGANESE	MG/KG	2516.77	4088.00	1600.00	950.00	399 =	417 =	285 =	311 =	337 R	345 R	382 R	188 =
MERCURY	MG/KG	0.04	61.32	2.35	2.10	0.013 U	0.013 U	0.0096 U	0.013 U	0.016 U	0.21 =	0.015 J	0.019 J
NICKEL	MG/KG	32.18	4088.00	156.43	100.00	0.38 J	0.4 J	0.37 J	0.53 J	0.48 J	0.48 J	0.63 J	0.88 J
POTASSIUM	MG/KG					442 J	419 J	464 J	440 J	236 J	233 J	310 J	291 J
SELENIUM	MG/KG	1.85	1022.00	39.11	18.98	0.53 J	0.65 J	0.34 J	0.65 J	0.26 U	0.23 U	0.22 U	0.6 J
SODIUM	MG/KG					106 J	118 J	83.7 J	127 J	98.9 J	104 J	135 J	402 J
THALLIUM	MG/KG		14.31	0.55	3.64	**0.68 J - R -**	**0.62 J - R -**	0.42 J	**0.89 J - R -**	0.34 U	0.29 U	0.43 J	**0.64 J - R -**
VANADIUM	MG/KG	169.89	1430.80	54.75	5111.02	23.9 =	19.9 =	18.8 =	23.4 =	29 J	29.9 J	21.3 J	43.7 =
ZINC	MG/KG	132.11	61320.00	2346.43	13621.80	13.8 =	5.1 =	4.7 =	16.7 =	14.1 =	93 =	12.8 =	9.9 =
Semi Volatile Organics													
1,3,5-TRINITROBENZENE	MG/KG					0.261 U	0.26 U	0.257 U	0.246 U	0.306 U	0.261 U	0.259 U	0.309 U
1,3-DINITROBENZENE	MG/KG					0.261 U	0.26 U	0.257 U	0.246 U	0.306 U	0.261 U	0.259 U	0.309 U
NITROBENZENE	MG/KG					0.511 U	0.468 U	0.427 U	0.427 U	0.563 UJ	0.465 UJ	0.469 UJ	0.421 UJ
2,6-DINITROTOLUENE	MG/KG			7.80	0.25	0.511 U	0.468 U	0.427 U	0.427 U	0.563 UJ	0.127 J	0.469 UJ	0.421 UJ
2,4-DINITROTOLUENE	MG/KG			16.00	0.57	0.511 U	0.468 U	0.427 U	0.427 U	0.563 UJ	**1.98 J - - L**	0.469 UJ	0.421 UJ
DIETHYL PHTHALATE	MG/KG			6300.00	450.00	0.511 U	0.468 U	0.427 U	0.427 U	0.563 UJ	0.465 UJ	0.091 J	0.038 J
N-NITROSODIPHENYLAMINE	MG/KG			13.00	0.76	0.511 U	0.468 U	0.427 U	0.427 U	0.563 UJ	0.17 J	0.469 UJ	0.421 UJ
DI-n-BUTYL PHTHALATE	MG/KG			780.00	5000.00	0.511 U	0.468 U	0.427 U	0.427 U	0.563 UJ	0.028 J	0.469 UJ	0.421 UJ
bis(2-ETHYLHEXYL) PHTHALATE	MG/KG			46.00	2900.00	0.511 U	0.468 U	0.427 U	0.427 U	0.563 UJ	0.041 J	0.469 UJ	0.421 UJ
Volatile Organics													
ACETONE	MG/KG			780.00	2.50	0.033 =	0.05 =	0.025 =	0.229 E	0.062 J	0.663 R	0.033 J	0.718 R
TOLUENE	MG/KG		40880.00	1564.29	8.79	0.012 U	0.011 U	0.012 U	0.01 U	0.0004 J	0.011 U	0.012 U	0.012 U
O-XYLENE (1,2-DIMETHYLBENZENE)	MG/KG		408800.00	15642.86	229.95	0.012 U	0.011 U	0.012 U	0.01 U	0.0003 J	0.011 U	0.012 U	0.012 U

The risk-based concentrations are based on a hazard quotient (HQ) of 0.1 and an excess lifetime cancer risk of 10 -6.
BKG = background (2 times average) values from AFWTF Camp Garcia Western Perimeter Study (November 1999)
Industrial RBC = EPA Region III Risk Based Concentration for Soil (Industrial)
Residential RBC = EPA Region III Risk Based Concentration for Soil (Residential)
SSL = EPA Region III Soil Screening Level for Groundwater Migration (with a dilution factor (DAF) of 20

Table 3-2
Surface Soil Analytical Data Summary
SWMU-04, NASD - Vieques, PR

Parameter	Units	BKG	Industrial RBC (I)	Residential RBC RBC-R (R)	SSL (L)	W4-SB05 NDA067 0 To 0.5 04/18/2000 14:55	W4-SB06 NDA069 0 To 0.5 04/18/2000 15:30	W4-SB07 NDA071 0 To 0.5 04/19/2000 9:00	W4-SB08 NDA074 0 To 0.5 04/19/2000 9:20	W4-SB09 NDA076 0 To 0.5 04/19/2000 9:50	W4-SB10 NDA078 0 To 0.5 04/19/2000 10:20	W4-SB11 NDA080 0 To 0.5 04/19/2000 11:10	W4-SB12 NDA082 0 To 0.5 04/19/2000 13:10
Explosives													
2,6-DINITROTOLUENE	MG/KG			7.80	0.25	0.378 UJ	0.32 UJ	0.554 UJ	0.448 UJ	0.419 UJ	0.44 UJ	0.407 UJ	4.66 UJ
OCTAHYDRO-1,3,5,7-TETRANITRO-1,3,5,7-TETRAZOCINE	MG/KG			390.00		0.268 UJ	0.255 UJ	0.292 U	0.262 U	0.259 U	2.15 =	0.254 U	0.125 UJ
HEXAHYDRO-1,3,5-TRINITRO-1,3,5,7-TETRAZOCINE	MG/KG			5.80	0.01	0.268 UJ	0.255 UJ	0.292 U	0.262 U	0.259 U	12.8 = - R L	0.254 U	0.125 UJ
2,4,6-TRINITROTOLUENE	MG/KG			21.00	0.06	0.268 UJ	0.255 UJ	0.292 U	0.262 U	0.259 U	5.57 = - - L	0.254 U	0.125 UJ
Metals													
ALUMINUM	MG/KG		204400.00	7821.43		8480 = - R -	5340 =	5080 =	4840 =	7600 =	4300 =	1960 =	1820 =
ARSENIC	MG/KG	2.08	3.82	0.43	0.03	0.64 J - R L	0.98 J - R L	0.81 J - R L	1.2 J - R L	0.67 J - R L	0.6 J - R L	0.36 U	0.36 J - - L
BARIUM	MG/KG	167.17	14308.00	547.50	2105.32	66.2 J	168 J	204 =	313 =	276 =	226 =	81.8 =	56 =
BERYLLIUM	MG/KG	0.58	408.80	15.64	1153.69	0.3 J	0.36 J	0.27 J	0.34 J	0.43 J	0.29 J	0.13 J	0.14 J
CADMIUM	MG/KG	0.35	102.20	3.91	27.45	0.022 U	0.021 U	0.024 U	0.021 U	0.021 U	0.021 U	0.021 U	0.02 U
CALCIUM	MG/KG					906 J	958 J	828 J	3470 =	4890 =	1010 J	1030 J	879 J
CHROMIUM, TOTAL	MG/KG	45.92	450.00	210.00	40.00	3.2 =	2.7 =	2.4 J	2.2 =	5.6 =	4.7 =	2.2 =	2 J
COBALT	MG/KG	39.41	12264.00	469.29		1.3 J	4.9 J	2.5 J	2.7 J	5.9 J	3.5 J	3.4 J	2.5 J
COPPER	MG/KG	147.78	8176.00	312.86	10517.84	2.2 J	16.5 =	8.9 =	6 =	7.9 =	11.9 =	5.5 =	5 J
IRON	MG/KG	9360.00	61320.00	2346.43		8800 = - R -	9320 = - R -	8330 = - R -	9370 = - R -	15700 = - R -	8820 = - R -	8950 = - R -	8240 = - R -
LEAD	MG/KG	4.19	100.00	40.00		6.3 =	75.4 = - R -	8.6 =	5.2 =	8.5 =	7 =	4 =	4.4 =
MAGNESIUM	MG/KG					929 J	529 J	848 J	1660 =	2150 =	953 J	454 J	438 J
MANGANESE	MG/KG	2516.77	4088.00	1600.00	950.00	39.9 =	537 =	264 =	171 =	692 =	207 =	435 =	273 =
MERCURY	MG/KG	0.04	61.32	2.35	2.10	0.013 U	0.015 J	0.014 U	0.011 U	0.012 U	0.013 U	0.012 U	0.012 U
NICKEL	MG/KG	32.18	4088.00	156.43	100.00	0.79 J	0.74 J	0.61 J	0.94 J	2.2 J	0.9 J	0.77 J	0.62 J
POTASSIUM	MG/KG					257 J	325 J	243 J	262 J	403 J	282 J	350 J	312 J
SELENIUM	MG/KG	1.85	1022.00	39.11	18.98	0.23 U	0.41 J	0.25 U	0.22 U	0.22 U	0.22 U	0.22 U	0.21 U
SODIUM	MG/KG					418 J	127 J	870 J	785 J	1220 J	1170 J	51.3 J	54.5 J
THALLIUM	MG/KG		14.31	0.55	3.64	0.29 U	0.46 J	0.59 J - R -	0.29 U	0.72 J - R -	0.46 J	0.53 J	0.31 J
VANADIUM	MG/KG	169.89	1430.80	54.75	5111.02	30.9 =	38 =	29.2 =	29.6 =	55.1 = - R -	30.6 =	30 =	28.9 =
ZINC	MG/KG	132.11	61320.00	2346.43	13621.80	7.8 =	22.4 =	12.5 =	17.9 =	19.6 =	17.9 =	8.6 =	9.6 =
Semi Volatile Organics													
1,3,5-TRINITROBENZENE	MG/KG					0.268 UJ	0.255 UJ	0.292 U	0.262 U	0.259 U	0.133 U	0.254 U	0.125 UJ
1,3-DINITROBENZENE	MG/KG					0.268 UJ	0.255 UJ	0.292 U	0.262 U	0.259 U	0.133 U	0.254 U	0.125 UJ
NITROBENZENE	MG/KG					0.378 UJ	0.32 UJ	0.554 UJ	0.448 UJ	0.419 UJ	0.44 UJ	0.407 UJ	4.66 UJ
2,6-DINITROTOLUENE	MG/KG			7.80	0.25	0.378 UJ	0.32 UJ	0.554 UJ	0.448 UJ	0.419 UJ	0.44 UJ	0.407 UJ	4.66 UJ
2,4-DINITROTOLUENE	MG/KG			16.00	0.57	0.378 UJ	0.32 UJ	0.554 UJ	0.448 UJ	0.419 UJ	0.44 UJ	0.407 UJ	4.66 UJ
DIETHYL PHTHALATE	MG/KG			6300.00	450.00	0.378 UJ	0.32 UJ	0.554 UJ	0.448 UJ	0.419 UJ	0.44 UJ	0.407 UJ	4.66 UJ
N-NITROSODIPHENYLAMINE	MG/KG			13.00	0.76	0.378 UJ	0.32 UJ	0.554 UJ	0.448 UJ	0.419 UJ	0.44 UJ	0.407 UJ	4.66 UJ
DI-n-BUTYL PHTHALATE	MG/KG			780.00	5000.00	0.378 UJ	0.32 UJ	0.554 UJ	0.448 UJ	0.419 UJ	0.44 UJ	0.407 UJ	4.66 UJ
bis(2-ETHYLHEXYL) PHTHALATE	MG/KG			46.00	2900.00	0.378 UJ	0.32 UJ	0.554 UJ	0.448 UJ	0.419 UJ	0.44 UJ	0.407 UJ	4.66 UJ
Volatile Organics													
ACETONE	MG/KG			780.00	2.50	0.015 R	0.382 R	0.012 U	0.06 R	0.01 R	0.014 R	0.01 R	0.013 R
TOLUENE	MG/KG		40880.00	1564.29	8.79	0.012 U	0.011 U	0.012 U	0.01 U	0.01 U	0.011 U	0.01 U	0.013 U
O-XYLENE (1,2-DIMETHYLBENZENE)	MG/KG		408800.00	15642.86	229.95	0.012 U	0.011 U	0.012 U	0.01 U	0.01 U	0.011 U	0.01 U	0.013 U

The risk-based concentrations are based on a hazard quotient (HQ) of 0.1 and an excess lifetime c
BKG = background (2 times average) values from AFWTF Camp Garcia Western Perimeter Study (N
Industrial RBC = EPA Region III Risk Based Concentration for Soil (Industrial)
Residential RBC = EPA Region III Risk Based Concentration for Soil (Residential)
SSL = EPA Region III Soil Screening Level for Groundwater Migration (with a dilution factor (DAF) of 2

Table 3-3
Subsurface Soil Analytical Data Summary
SWMU 4, NASD - Vieques, PR

StationID				SWMU4-MW05	SWMU4-MW06	SWMU4-MW07	SWMU4-MW08	W4-SB01	W4-SB02	W4-SB03	W4-SB04	W4-SB05	W4-SB06	W4-SB07	W4-SB08	W4-SB09	W4-SB10	W4-SB11	W4-SB12
SampleID				NDB002	NDB005	NDB007	NDB009	NDA058	NDA060	NDA063	NDA066	NDA068	NDA070	NDA073	NDA075	NDA077	NDA079	NDA081	NDA083
Collection Depth				4 To 6	4 To 6	4 To 6	4 To 6	4 To 6	4 To 6	4 To 6	4 To 6	4 To 6	4 To 6	4 To 6	4 To 6	4 To 6	4 To 6	4 To 6	4 To 6
Date Collected		Screening Criteria		06/06/2000 11:00	06/06/2000 13:45	06/06/2000 14:45	06/06/2000 10:40	04/18/2000 10:40	04/18/2000 13:30	04/18/2000 14:15	04/18/2000 15:30	04/18/2000 15:50	04/19/2000 10:30	04/19/2000 13:00	04/19/2000 13:30	04/19/2000 14:15	04/19/2000 14:30	04/19/2000 15:20	04/19/2000 15:45
Parameter Name	Units	BKG	SSL (L)																
Metals																			
ALUMINUM	MG/KG			3510 =	2030 =	2440 =	3140 =	7470 J	4610 J	7700 =	7150 =	11500 =	7760 =	3050 =	5850 =	5110 =	8500 =	6020 =	2080 =
ARSENIC	MG/KG	2.08	0.03	1.2 J -	0.75 J -	0.83 J -	0.97 J -	0.66 J -	0.62 J -	1.8 J -	1.1 J -	2.3 = -	0.83 J -	0.58 J -	1.2 J -	0.88 J -	0.85 J -	0.36 U	0.35 U
BARIUM	MG/KG	167.17	2105.32	364 =	78.6 =	101 =	87.5 =	702 R	177 R	504 J	103 J	3170 J -	892 R	108 =	247 =	387 =	164 =	219 =	104 =
BERYLLIUM	MG/KG	0.58	1153.69	0.29 J	0.26 J	0.26 J	0.2 J	0.37 J	0.27 J	0.6 J	0.47 J	1.3 =	0.38 J	0.66 J	0.43 J	0.38 J	0.55 J	0.26 J	0.16 J
CALCIUM	MG/KG			976 J	470 J	961 J	1120 J	821 J	668 J	1310 =	1000 J	2970 =	37000 =	611 J	2540 =	2050 =	8790 =	894 J	1090 =
CHROMIUM, TOTAL	MG/KG	45.92	40.00	19 =	3.6 =	2 J	5.8 =	7 =	9.7 =	10 =	4.5 =	3.7 =	7.8 =	3 =	6.4 =	3.7 =	5.7 =	14.7 =	1.9 J
COBALT	MG/KG	39.41		6.1 J	2.1 J	1.9 J	3.7 J	3.6 J	4.4 J	5.5 J	3.8 J	2.5 J	3.7 J	6 J	4.3 J	7.1 J	8 J	2.4 J	3 J
COPPER	MG/KG	147.78	10517.84	7.9 =	2.7 J	5.7 =	11.3 =	5.2 J	8.1 =	10 =	3.1 J	4.7 J	9.7 =	4 J	6.8 =	7.7 =	7.2 =	2.3 J	3.4 J
IRON	MG/KG	9360.00		7700 =	6170 =	4920 =	6790 =	8390 J	5530 J	16000 =	10400 =	14200 =	10400 =	10000 =	13900 =	12000 =	22700 =	4470 =	6530 =
LEAD	MG/KG	4.19		11.9 =	4.2 =	4 =	8.6 =	7.8 J	10 J	21.1 =	7.2 =	7.7 =	20.7 =	4.8 =	7.7 =	9 =	7.5 =	5.6 =	4.6 =
MAGNESIUM	MG/KG			957 J	806 J	938 J	670 J	983 J	673 J	1340 =	1000 J	4620 =	2660 =	1160 =	2950 =	1330 =	2380 =	538 J	382 J
MANGANESE	MG/KG	2516.77	950.00	696 =	362 =	412 =	367 =	956 R	703 R	742 =	280 =	574 =	477 =	447 =	460 =	906 =	761 =	169 =	321 =
NICKEL	MG/KG	32.18	100.00	7.1 J	0.49 J	0.54 J	1.3 J	2.5 J	3.6 J	1.8 J	1.1 J	1.8 J	4.4 J	0.89 J	2.3 J	2.2 J	2 J	2 J	0.47 J
POTASSIUM	MG/KG			479 J	407 J	433 J	566 J	321 J	231 J	357 J	238 J	373 J	433 J	293 J	290 J	340 J	262 J	198 J	263 J
SELENIUM	MG/KG	1.85	18.98	0.41 J	0.22 U	0.33 J	0.38 J	0.26 J	0.23 U	0.23 U	0.22 U	0.23 U	0.22 U	0.29 J	0.22 U	0.25 U	0.24 U	0.22 U	0.22 U
SODIUM	MG/KG			416 J	655 J	590 J	226 J	1220 =	740 J	1510 J	448 J	3730 J	1370 J	912 J	1420 J	653 J	1960 J	453 J	93.6 J
THALLIUM	MG/KG		3.64	0.76 J	0.55 J	0.45 J	0.33 U	0.3 U	0.3 U	0.97 J	0.51 J	0.64 J	0.29 U	0.31 J	0.64 J	0.77 J	1.1 J	0.29 U	0.33 J
VANADIUM	MG/KG	169.89	5111.02	31.6 =	19.4 =	14.7 =	19 =	35.5 J	23.2 J	71.9 =	31.5 =	35 =	37.1 =	31.3 =	33.8 =	47.2 =	87.9 =	17.7 =	25.1 =
ZINC	MG/KG	132.11	13621.80	15 =	13.6 =	15.1 =	19 =	9.6 =	14.7 =	14.8 =	13 =	26.1 =	20.6 =	14.9 =	24.5 =	15.8 =	13.6 =	8.1 =	6.6 =
Semi-Volatiles																			
BENZYL BUTYL PHTHALATE	MG/KG		17000.00	0.468 U	0.467 U	0.407 U	0.056 J	0.46 UJ	0.478 UJ	0.382 UJ	0.344 UJ	0.36 UJ	0.404 UJ	0.383 UJ	0.401 UJ	0.441 UJ	0.466 UJ	0.393 UJ	4.24 UJ
bis(2-ETHYLHEXYL) PHTHALATE	MG/KG		2900.00	0.468 U	0.467 U	0.407 U	0.527 U	0.46 UJ	0.478 UJ	0.382 UJ	0.344 UJ	0.36 UJ	0.101 J	0.383 UJ	0.401 UJ	0.441 UJ	0.466 UJ	0.393 UJ	4.24 UJ
Volatiles																			
ACETONE	MG/KG		2.50	0.123 =	0.055 =	0.048 =	0.017 =	0.011 R	0.03 R	0.022 R	0.551 R	0.026 R	0.016 R	0.012 R	0.013 R	0.018 R	0.011 R	0.01 R	0.012 R
METHYL ETHYL KETONE (2-BUTANONE)	MG/KG		7.90	0.006 J	0.003 J	0.011 U	0.011 U	0.01 R	0.003 J	0.011 R	0.01 R	0.011 R	0.01 R	0.01 R	0.01 R	0.01 R	0.01 R	0.01 R	0.01 R
BENZENE	MG/KG		0.002	0.01 U	0.0001 U	0.011 U	0.0002 J	0.01 UJ	0.01 U	0.011 UJ	0.01 UJ	0.011 U	0.01 UJ	0.01 U	0.01 U	0.01 U	0.01 U	0.01 UJ	0.0001 U
METHYL ISOBUTYL KETONE	MG/KG			0.01 U	0.002 J	0.011 U	0.011 U	0.01 UJ	0.01 U	0.011 UJ	0.01 UJ	0.011 U	0.01 UJ	0.01 U	0.01 U	0.01 U	0.01 U	0.01 UJ	0.01 U
M,P-XYLENE (SUM OF ISOMERS)	MG/KG		170.00	0.01 U	0.0003 J	0.011 U	0.011 U	0.01 UJ	0.01 U	0.011 UJ	0.01 UJ	0.011 U	0.01 UJ	0.01 U	0.01 U	0.01 U	0.01 U	0.01 UJ	0.01 U
STYRENE	MG/KG		57.00	0.01 U	0.011 U	0.011 U	0.011 U	0.01 UJ	0.01 U	0.011 UJ	0.01 UJ	0.0006 J	0.011 U	0.01 UJ	0.01 U	0.01 U	0.01 U	0.01 UJ	0.01 U
XYLENES, TOTAL	MG/KG		170.19	0.01 U	0.0003 J	0.011 U	0.011 U	0.01 UJ	0.01 U	0.011 UJ	0.01 UJ	0.011 U	0.01 UJ	0.01 U	0.01 U	0.01 U	0.01 U	0.01 UJ	0.01 U

The risk-based concentrations are based on a hazard quotient (HQ) of 0.1 and an excess lifetime cancer risk of 10 -6.
BKG = background (2 times average) values from AFWTF Camp Garcia Western Perimeter Study (November 1999)
SSL = EPA Region III Soil Screening Level for Groundwater Migration (with a dilution factor (DAF) of 20

Table 4-1
Surface Soil Analytical Data Summary
SWMU-05, NASD - Vieques, PR

	StationID		Screening Criteria			W5-SB01	W5-SB02	W5-SB03	W5-SB04
	SampleID					NDA084	NDA086	NDA088	NDA091
	Collection Depth					0 To 0.5	0 To 0.8	0 To 2	0 To 2
	Date Collected					04/13/2000 12:50	04/14/2000 9:20	04/14/2000 11:00	04/17/2000 9:50
Parameter	Units	BKG	RBC-I (I)	RBC-R (R)	SSL (L)				
Semi-Volatiles									
FLUORANTHENE	MG/KG		8176.00	312.86	6254.64	0.068 J	0.364 U	0.346 U	0.041 J
PYRENE	MG/KG		6132.00	234.64	682.00	0.065 J	0.364 U	0.346 U	0.067 J
BENZO(a)ANTHRACENE	MG/KG		7.84	0.87	1.46	0.023 J	0.364 U	0.346 U	0.038 J
CHRYSENE	MG/KG		784.00	87.50	146.09	0.062 J	0.364 U	0.346 U	0.06 J
BENZO(b)FLUORANTHENE	MG/KG		7.84	0.87	4.51	0.144 J	0.364 U	0.346 U	0.05 J
BENZO(k)FLUORANTHENE	MG/KG		78.40	8.75	45.14	0.074 J	0.364 U	0.346 U	0.059 J
BENZO(a)PYRENE	MG/KG		0.78	0.087	0.37	0.088 J - R - -	0.364 U	0.346 U	0.075 J
INDENO(1,2,3-c,d)PYRENE	MG/KG		7.84	0.87	12.73	0.037 J	0.364 U	0.346 U	0.068 J
BENZO(g,h,i)PERYLENE	MG/KG			0.87	12.73	0.041 J	0.364 U	0.346 U	0.093 J
Volatiles									
CARBON DISULFIDE	MG/KG			780.00	19.00	0.013 UJ	0.0007 J	0.0005 J	0.0006 J
METHYL ETHYL KETONE (2-BUTANONE)	MG/KG			4700.00	7.90	0.002 J	0.011 R	0.01 R	0.011 R
TOLUENE	MG/KG		40880	1564.29	8.79	0.0004 J	0.011 U	0.01 U	0.011 U
STYRENE	MG/KG			1600.00	57.00	0.013 UJ	0.011 U	0.01 U	0.0006 J

The risk-based concentrations are based on a hazard quotient (HQ) of 0.1 and an excess lifetime cancer risk of 10 -6.
BKG = background (2 times average) values from AFWTF Camp Garcia Western Perimeter Study (November 1999)
Industrial RBC = EPA Region III Risk Based Concentration for Soil (Industrial)
Residential RBC = EPA Region III Risk Based Concentration for Soil (Residential)
SSL = EPA Region III Soil Screening Level for Groundwater Migration (with a dilution factor (DAF) of 20

Table 5-1
Groundwater Analytical Data Summary
SWMU 6, NASD - Vieques, PR

StationID					SWMU6-MW01	SWMU6-MW02	SWMU6-MW03	SWMU6-MW04
SampleID					NDA006	NDA008	NDA009	NDA005
Date Collected		Screening Criteria			05/02/2000 13:45	05/02/2000 12:55	05/02/2000 11:00	05/02/2000 10:00
Paramater Name	Units	BKG	Federal MCL (M)	Tapwater RBC (T)				
Dissolved Metals								
ANTIMONY, DISSOLVED	MG/L		0.01	0.0015	0.0014 U	0.0014 U	0.0018 J	0.0014 U
ARSENIC, DISSOLVED	MG/L	0.01	0.05	0.00004	0.0073 J	0.0048 J	0.0059 J	0.0133 =
BARIUM, DISSOLVED	MG/L	0.28	2.00	0.26	0.481 = - T	0.294 = - T	0.179 J	0.381 = - T
CALCIUM, DISSOLVED	MG/L				694 =	498 =	574 =	567 =
CADMIUM, DISSOLVED	MG/L	0.004	0.005	0.0018	0.0029 J - T	0.0018 J	0.002 J - T	0.002 J - T
CHROMIUM, DISSOLVED	MG/L	0.02	0.10	0.11	0.0047 J	0.0005 U	0.0005 U	0.0045 J
COBALT, DISSOLVED	MG/L	0.02		0.22	0.00055 J	0.0005 U	0.0005 U	0.00092 J
IRON, DISSOLVED	MG/L		0.30	1.10	0.0122 R	0.0127 J	0.0122 R	0.0122 R
LEAD, DISSOLVED	MG/L		0.01		0.003 J	0.0027 J	0.0038 =	0.0026 J
MAGNESIUM, DISSOLVED	MG/L				1520 =	1530 =	1530 =	1510 =
MANGANESE, DISSOLVED	MG/L		0.05	0.07	11.8 = M T	2.07 = M T	1.17 = M T	10.6 = M T
NICKEL, DISSOLVED	MG/L	0.02	0.10	0.07	0.0016 J	0.0021 J	0.001 J	0.004 J
SELENIUM, DISSOLVED	MG/L	0.02	0.05	0.02	0.0057 =	0.005 J	0.0021 U	0.0064 =
SILVER, DISSOLVED	MG/L				0.00093 J	0.0005 U	0.0005 U	0.0021 J
SODIUM, DISSOLVED	MG/L				7360 =	12200 =	12100 =	9720 =
VANADIUM, DISSOLVED	MG/L	0.04		0.03	0.0027 J	0.0045 J	0.0048 J	0.0081 J
Total Metals								
ALUMINUM	MG/L		0.05	3.65	**0.306** = M -	**1.46** = M -	**0.182** J M -	**0.164** J M -
ANTIMONY	MG/L		0.01	0.0015	0.0014 U	**0.0037** J - T	0.0014 U	0.0014 U
ARSENIC	MG/L	0.01	0.05	0.00004	**0.0068** J - T	**0.0035** J - T	**0.0065** J - T	**0.01** = - T
BARIUM	MG/L	0.28	2.00	0.26	**0.519** = - T	**0.283** = - T	0.194 J	**0.425** = - T
BERYLLIUM	MG/L	0.000	0.004	0.007	0.00032 J	0.00044 J	0.00042 J	0.00033 J
CADMIUM	MG/L	0.004	0.005	0.002	**0.0033** J - T	**0.002** J - T	**0.0028** J - T	**0.0028** J - T
CALCIUM	MG/L				860 =	555 =	712 =	691 =
CHROMIUM, TOTAL	MG/L	0.02	0.10	0.11	0.0057 J	0.0042 J	0.0027 J	0.0089 J
COBALT	MG/L	0.02		0.22	0.004 J	0.0005 U	0.0005 U	0.0017 J
COPPER	MG/L	0.04	1.00	0.15	0.0019 U	0.01 J	0.0019 U	0.0019 U
IRON	MG/L		0.30	1.10	**0.324** J M -	**2.5** J M T	0.043 J	0.0555 J
LEAD	MG/L		0.01		0.0035 =	**0.0252** = M -	0.0018 J	0.0043 =
MAGNESIUM	MG/L				1580 =	1570 =	1590 =	1570 =
MANGANESE	MG/L		0.05	0.07	**14.3** = M T	**2.07** = M T	**1.38** = M T	**13.8** = M T
NICKEL	MG/L	0.02	0.10	0.07	0.0027 J	0.0037 J	0.0015 J	0.0044 J
SELENIUM	MG/L	0.02	0.05	0.02	0.0072 =	0.0029 J	0.0059 =	0.0071 =
SODIUM	MG/L				9740 =	11800 =	11900 =	11800 =
VANADIUM	MG/L	0.04		0.03	0.0037 J	0.0099 J	0.006 J	0.0075 J
ZINC	MG/L	0.14	5.00	1.10	0.0125 U	0.0125 U	0.0125 U	0.177 =
PCBs								
PCB-1221 (AROCHLOR 1221)	MG/L		0.0005	0.00003	0.00043 U	0.00042 U	0.00043 U	**0.0007** = M T
PCB-1232 (AROCHLOR 1232)	MG/L		0.0005	0.00003	0.00022 U	0.00021 U	0.00022 U	**0.00009** J - T

Table 5-2
Surface Soil Analytical Data Summary
SWMU-06, NASD - Vieques, PR

StationID					W6-SB01	W6-SB01	W6-SB02	W6-SB02	W6-SB03	W6-SB03	W6-SB04	W6-SB04	W6-SB05	W6-SB06	W6-SB07	W6-SB08
SampleID					NDA101	NDA102	NDA103	NDA105	NDA107	NDA108	NDA109	NDA110	NDA111	NDA113	NDA115	NDA117
Collection Depth			Industrial	Residential												
Date Collected			RBC	RBC	SSL	0 To 0.5	1 To 1.5	0 To 0.5	0.7 To 1.2	0 To 0.5	1 To 1.5	0 To 0.5	0.5 To 0.7	0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5
Parameter	Units	BKG	(I)	(R)	(L)	04/24/2000 13:00	04/24/2000 13:15	04/24/2000 13:40	04/24/2000 14:00	04/24/2000 9:45	04/24/2000 10:00	04/24/2000 10:10	04/24/2000 10:15	04/24/2000 10:30	04/20/2000 14:10	04/20/2000 14:50	04/20/2000 15:25
Metals																
ALUMINUM	MG/KG		204400.00	7821.43	5170 =	**9320** = - R -	4900 =	5860 =	5810 =	5440 =	**10900** = - R -	**10300** = - R -	**11600** = - R -	**14000** = - R -	**11100** = - R -	**12200** = - R -
ANTIMONY	MG/KG	1.76	81.76	3.13	13.20	**13.3** J - R L	**4.1** J - R -	0.19 UJ	0.61 J	1 J	0.93 J	0.47 J	0.53 J	0.82 J	0.74 J	0.34 J	0.46 J
ARSENIC	MG/KG	2.08	3.82	0.43	0.03	**7.6** = I R L	**2.2** J - R L	**1.9** J - R L	**0.76** J - R L	**1.6** J - R L	**2** J - R L	**0.93** J - R L	**1** J - R L	**1.5** J - R L	**1** J - R L	**1.1** J - R L	**0.99** J - R L
BARIUM	MG/KG	167.17	14308.00	547.50	2105.32	19.3 J	20.4 J	12.8 J	12.9 J	26.5 J	27.9 J	36.1 J	19.3 J	18.2 J	29.5 J	28.8 J	37.6 J
BERYLLIUM	MG/KG	0.58	408.80	15.64	1153.69	0.041 U	0.048 J	0.042 U	0.049 U	0.054 J	0.055 J	0.12 J	0.14 J	0.069 J	0.12 J	0.11 J	0.11 J
CADMIUM	MG/KG	0.35	102.20	3.91	27.45	0.33 J	0.44 J	0.35 J	0.33 J	0.028 J	0.027 U	1.4 =	0.48 J	0.61 J	0.025 U	0.023 U	0.23 J
CALCIUM	MG/KG					90500 J	86500 J	134000 J	122000 J	97200 J	88400 J	70800 J	40100 J	108000 J	35400 J	64900 =	65800 =
CHROMIUM, TOTAL	MG/KG	45.92	450.00	210.00	40.00	28 =	11.6 =	6.4 =	5.7 =	12.9 =	9.7 =	14.3 =	17.8 =	14.9 =	**42.9** = - - L	35.7 =	23.3 =
COBALT	MG/KG	39.41	12264.00	469.29		6 J	3.5 J	2.4 J	2.1 J	4 J	4.2 J	8.9 J	9.4 J	3.3 J	12.8 =	11.5 =	9.1 J
COPPER	MG/KG	147.78	8176.00	312.86	10517.84	121 =	51.5 =	16.1 =	15 =	38.7 =	35.7 =	36.8 =	38.2 =	250 =	114 J	52.3 J	114 J
IRON	MG/KG	9360.00	61320.00	2346.43		**75200** = I R -	**21900** = - R -	**8920** = - R -	**7330** = - R -	**16000** = - R -	**17900** = - R -	**20600** = - R -	**25100** = - R -	**16100** = - R -	**22900** = - R -	**16900** = - R -	**18500** = - R -
LEAD	MG/KG	4.19	100.00	40.00		**617** = I R -	**332** = I R -	17.5 =	25.8 =	**104** = I R -	**97.8** = - R -	22.5 =	16.9 =	**67.5** = - R -	36.1 =	3.9 =	25.8 =
MAGNESIUM	MG/KG					5180 =	5580 =	4180 =	3810 =	3800 =	3130 =	6870 =	8130 =	5750 =	9050 =	6600 =	7630 =
MANGANESE	MG/KG	2516.77	4088.00	1600.00	950.00	415 =	227 =	128 =	117 =	276 =	219 =	331 =	295 =	137 =	465 J	390 J	379 J
MERCURY	MG/KG	0.04	61.32	2.35	2.10	0.081 J	0.053 J	0.015 UJ	0.042 J	0.081 J	0.072 J	0.019 UJ	0.012 UJ	0.038 J	0.014 U	0.013 U	0.016 U
NICKEL	MG/KG	32.18	4088.00	156.43	100.00	13 =	5.1 J	2.4 J	2.3 J	4.4 J	4.5 J	9.2 J	9.7 J	4 J	20 =	16.5 =	10.7 =
POTASSIUM	MG/KG					1740 J	2630 J	1900 J	2670 J	1820 J	1810 J	2700 J	2510 J	2610 J	1460 =	1570 =	2440 =
SILVER	MG/KG		1022.00	39.11	31.03	0.36 J	0.11 J	0.069 U	0.081 U	0.14 J	0.27 J	0.099 J	0.066 U	0.12 J	0.41 J	0.057 U	0.13 J
SODIUM	MG/KG					12100 =	16500 =	13700 =	15400 =	6300 =	6120 =	5390 =	4200 =	14200 =	3250 =	4700 =	4040 =
THALLIUM	MG/KG		14.31	0.55	3.64	**4.3** = - R L	**1.5** J - R -	0.37 U	0.44 U	0.34 U	**1.3** J - R -	**0.77** J - R -	**1.5** J - R -	**0.82** J - R -	0.34 U	0.31 U	0.34 U
VANADIUM	MG/KG	169.89	1430.80	54.75	5111.02	23.2 =	27.9 =	19.9 =	20.7 =	27.7 =	27.3 =	**65.8** = - R -	**80.2** = - R -	26.5 =	**66** = - R -	51.2 =	51 =
ZINC	MG/KG	132.11	61320.00	2346.43	13621.80	438 =	216 =	42 =	37.5 =	82.2 =	68.1 =	86.3 =	58.1 =	138 =	96.5 =	29.5 =	83.7 =
Pesticides																	
p,p'-DDE	MG/KG		16.83	1.88	35.22	0.029 J	0.03 J	0.0038 J	0.011 J	0.0067 J	0.0058 J	0.0012 J	0.00088 J	0.0075 J	0.074 J	0.0018 J	0.046 J
p,p'-DDD	MG/KG		23.85	2.66	11.16	0.011 J	0.013 J	0.0045 UJ	0.00084 J	0.0042 UJ	0.001 J	0.00062 J	0.0044 UJ	0.002 J	0.0041 UJ	0.0038 UJ	0.013 J
p,p'-DDT	MG/KG		16.83	1.88	1.16	0.0072 J	0.0052 UJ	0.0045 UJ	0.0053 UJ	0.003 J	0.0018 J	0.0043 UJ	0.0044 UJ	0.0044 UJ	0.017 J	0.0038 UJ	0.007 J
ALPHA-CHLORDANE	MG/KG		16.35	1.82	0.92	0.0023 UJ	0.0026 UJ	0.0023 UJ	0.0027 UJ	0.0021 UJ	0.0023 UJ	0.0022 UJ	0.0023 UJ	0.0022 UJ	0.00061 J	0.0019 UJ	0.0021 UJ
Semi-Volatile Organics																	
NAPHTHALENE	MG/KG		4088.00	156.43	0.15	0.549 U	0.684 U	0.627 U	0.748 U	0.506 U	0.637 U	0.503 U	0.567 U	**0.621** = - - L	0.551 U	0.558 U	0.76 U
2-METHYLNAPHTHALENE	MG/KG		4088.00	156.43	22.23	0.549 U	0.684 U	0.627 U	0.748 U	0.506 U	0.637 U	0.503 U	0.567 U	0.311 J	0.551 U	0.558 U	0.76 U
ACENAPHTHENE	MG/KG			470.00	100.00	0.549 U	0.684 U	0.627 U	0.748 U	0.506 U	0.637 U	0.503 U	0.567 U	0.684 =	0.551 U	0.558 U	0.76 U
DIBENZOFURAN	MG/KG			31.00	7.70	0.549 U	0.684 U	0.627 U	0.748 U	0.506 U	0.637 U	0.503 U	0.567 U	0.784 =	0.551 U	0.558 U	0.76 U
FLUORENE	MG/KG		8176.00	312.86	135.29	0.549 U	0.684 U	0.627 U	0.748 U	0.506 U	0.637 U	0.503 U	0.567 U	0.44 J	0.551 U	0.558 U	0.76 U
PHENANTHRENE	MG/KG			234.64	682.00	0.549 U	0.085 J	0.627 U	0.748 U	0.506 U	0.637 U	0.503 U	0.567 U	4.86 =	0.551 U	0.558 U	0.76 U
ANTHRACENE	MG/KG		61320.00	2346.43	465.60	0.549 U	0.038 U	0.627 U	0.748 U	0.506 U	0.637 U	0.503 U	0.567 U	0.902 =	0.551 U	0.558 U	0.76 U
FLUORANTHENE	MG/KG		8176.00	312.86	6254.64	0.034 U	0.125 J	0.627 U	0.748 U	0.506 U	0.637 U	0.503 U	0.567 U	4.06 =	0.551 U	0.558 U	0.05 J
PYRENE	MG/KG		6132.00	234.64	682.00	0.037 J	0.195 J	0.627 U	0.748 U	0.506 U	0.637 U	0.503 U	0.567 U	2.9 =	0.033 J	0.558 U	0.051 J
BENZO(a)ANTHRACENE	MG/KG		7.84	0.87	1.46	0.549 U	0.1 J	0.627 U	0.748 U	0.506 U	0.637 U	0.503 U	0.567 U	**1.87** = - R L	0.551 U	0.558 U	0.041 J
CHRYSENE	MG/KG		784.00	87.50	146.09	0.549 U	0.122 J	0.627 U	0.748 U	0.506 U	0.637 U	0.503 U	0.567 U	2 =	0.052 J	0.558 U	0.118 J
bis(2-ETHYLHEXYL) PHTHALATE	MG/KG			46.00	2900.00	1.4 =	0.684 U	0.627 U	0.748 U	0.506 U	0.135 J	0.503 U	0.567 U	0.607 U	0.135 J	0.558 U	0.76 U
BENZO(b)FLUORANTHENE	MG/KG		7.84	0.87	4.51	0.549 U	0.081 J	0.627 U	0.748 U	0.506 U	0.033 U	0.503 U	0.567 U	**1.8** = - R -	0.068 J	0.558 U	0.121 J
BENZO(k)FLUORANTHENE	MG/KG		78.40	8.75	45.14	0.549 U	0.075 J	0.627 U	0.748 U	0.506 U	0.045 U	0.503 U	0.567 U	1.23 =	0.059 J	0.558 U	0.088 J
BENZO(a)PYRENE	MG/KG		0.78	0.09	0.37	0.549 U	**0.123** J - R -	0.627 U	0.748 U	0.506 U	0.637 U	0.503 U	0.567 U	**1.51** = I R L	0.052 J	0.558 U	0.081 J
INDENO(1,2,3-c,d)PYRENE	MG/KG		7.84	0.87	12.73	0.549 U	0.07 J	0.627 U	0.748 U	0.506 U	0.637 U	0.503 U	0.567 U	0.653 =	0.05 J	0.558 U	0.074 J
DIBENZ(a,h)ANTHRACENE	MG/KG		0.78	0.09	1.39	0.549 U	0.684 U	0.627 U	0.748 U	0.506 U	0.637 U	0.503 U	0.567 U	**0.254** J - R -	0.551 U	0.558 U	0.76 U
BENZO(g,h,i)PERYLENE	MG/KG			0.87	12.73	0.549 U	0.069 J	0.627 U	0.748 U	0.506 U	0.637 U	0.503 U	0.567 U	0.432 J	0.04 J	0.558 U	0.056 J
CARBAZOLE	MG/KG		286.16	31.94	0.47	0.549 U	0.684 U	0.627 U	0.748 U	0.506 U	0.637 U	0.503 U	0.567 U	0.431 J	0.551 U	0.558 U	0.76 U
Volatile Organics																	
CARBON DISULFIDE	MG/KG			780.00	19.00	0.002 J	0.002 J	0.002 J	0.004 J	0.012 U	0.002 J	0.011 U	0.011 U	0.0007 J	0.01 U	0.01 U	0.01 UJ
METHYL ETHYL KETONE (2-BUTANONE)	MG/KG			4700.00	7.90	0.003 J	0.003 J	0.013 R	0.017 R	0.012 R	0.013 R	0.011 R	0.011 R	0.012 R	0.01 R	0.01 R	0.01 R
BENZENE	MG/KG		197.35	22.03	0.00	0.014 U	0.014 U	0.013 U	0.0002 J	0.012 U	0.013 U	0.011 U	0.011 U	0.012 U	0.01 U	0.01 U	0.01 UJ
TOLUENE	MG/KG		40880.00	1564.29	8.79	0.014 U	0.014 U	0.013 U	0.0009 J	0.012 U	0.013 U	0.011 U	0.011 U	0.012 U	0.01 U	0.01 U	0.0008 J
TETRACHLOROETHYLENE(PCE)	MG/KG		110.00	12.00	0.05	0.014 U	0.014 U	0.013 U	0.002 J	0.012 U	0.013 U	0.011 U	0.011 U	0.012 U	0.01 U	0.01 U	0.01 UJ
ETHYLBENZENE	MG/KG		20000.00	780.00	15.00	0.014 U	0.014 U	0.013 U	0.001 J	0.012 U	0.013 U	0.011 U	0.011 U	0.012 U	0.01 U	0.01 U	0.001 J
M,P-XYLENE (SUM OF ISOMERS)	MG/KG			16000.00	170.00	0.0007 J	0.0006 J	0.013 U	0.017 U	0.012 U	0.013 U	0.011 U	0.011 U	0.012 U	0.01 U	0.01 U	0.004 J
O-XYLENE (1,2-DIMETHYLBENZENE)	MG/KG		408800.00	15642.86	229.95	0.014 U	0.014 U	0.013 U	0.002 J	0.012 U	0.013 U	0.011 U	0.011 U	0.012 U	0.01 U	0.01 U	0.002 J
XYLENES, TOTAL	MG/KG		408800.00	15642.86	170.19	0.0007 J	0.0006 J	0.013 U	0.017 U	0.012 U	0.013 U	0.011 U	0.011 U	0.012 U	0.01 U	0.01 U	0.006 J

The risk-based concentrations are based on a hazard quotient (HQ) of 0.1 and an excess lifetime cancer risk of 10 -6.
BKG = background (2 times average) values from AFWTF Camp Garcia Western Perimeter Study (November 1999)
Industrial RBC = EPA Region III Risk Based Concentration for Soil (Industrial)
Residential RBC = EPA Region III Risk Based Concentration for Soil (Residential)
SSL = EPA Region III Soil Screening Level for Groundwater Migration (with a dilution factor (DAF) of 20

Table 5-3
Subsurface Soil Analytical Data Summary
SWMU 6, NASD - Vieques, PR

StationID				W6-SB05	W6-SB06	W6-SB07	W6-SB08
SampleID				NDA112	NDA114	NDA116	NDA118
Collection Depth				3 To 3.5	1.8 To 2.3	2.3 To 3	2.3 To 3
Date Collected		Screening Criteria		04/24/2000 10:40	04/20/2000 14:20	04/20/2000 15:10	04/20/2000 16:00
Parameter Name	Units	BKG	SSL (L)				
Metals							
ALUMINUM	MG/KG			5190 =	12500 =	6470 =	7190 =
ANTIMONY	MG/KG	1.76	13.20	0.19 UJ	0.46 J	0.18 UJ	0.18 UJ
ARSENIC	MG/KG	2.08	0.03	1.2 J L	0.88 J L	1.1 J L	1.1 J L
BARIUM	MG/KG	167.17	2105.32	12.6 J	36.9 J	24 J	24.3 J
BERYLLIUM	MG/KG	0.58	1153.69	0.04 U	0.092 J	0.066 J	0.072 J
CADMIUM	MG/KG	0.35	27.45	0.63 J	0.29 J	0.16 J	0.14 J
CALCIUM	MG/KG			106000 J	91800 =	99400 =	93700 =
CHROMIUM, TOTAL	MG/KG	45.92	40.00	5.9 =	25.4 =	6.3 =	6.7 =
COBALT	MG/KG	39.41		1.9 J	8.2 J	2.2 J	2.2 J
COPPER	MG/KG	147.78	10517.84	34.4 =	137 J	37.1 J	10 J
IRON	MG/KG	9360.00		5910 =	15400 =	7980 =	8230 =
LEAD	MG/KG	4.19		8.8 =	16.1 =	2.3 =	2.8 =
MAGNESIUM	MG/KG			2920 =	5220 =	3130 =	3490 =
MANGANESE	MG/KG	2516.77	950.00	72 =	343 J	213 J	170 J
MERCURY	MG/KG	0.04	2.10	0.018 UJ	0.018 J	0.016 U	0.016 U
NICKEL	MG/KG	32.18	100.00	1.8 J	12.4 =	1.4 J	1.8 J
POTASSIUM	MG/KG			1590 J	1840 =	2220 =	2490 =
SELENIUM	MG/KG	1.85	18.98	0.28 U	0.27 U	0.26 U	0.29 J
SILVER	MG/KG		31.03	0.067 U	0.19 J	0.063 U	0.065 U
SODIUM	MG/KG			8370 =	4790 =	5710 =	6230 =
VANADIUM	MG/KG	169.89	5111.02	19.4 =	37.1 =	20.1 =	21.1 =
ZINC	MG/KG	132.11	13621.80	23.5 =	200 =	14.5 =	14.9 =
Pesticides							
p,p'-DDE	MG/KG		35.22	0.002 J	0.316 J	0.0042 UJ	0.0043 UJ
p,p'-DDD	MG/KG		11.16	0.00032 J	0.012 J	0.0042 UJ	0.0043 UJ
p,p'-DDT	MG/KG		1.16	0.0043 UJ	0.019 J	0.0042 UJ	0.0043 UJ
Semi-Volatiles							
FLUORANTHENE	MG/KG		6254.64	0.043 J	0.629 U	0.696 U	0.548 U
PYRENE	MG/KG		682.00	0.031 J	0.629 U	0.696 U	0.548 U
CHRYSENE	MG/KG		146.09	0.536 U	0.045 J	0.696 U	0.548 U
BENZO(b)FLUORANTHENE	MG/KG		4.51	0.536 U	0.087 J	0.696 U	0.548 U
BENZO(k)FLUORANTHENE	MG/KG		45.14	0.536 U	0.052 J	0.696 U	0.548 U
BENZO(a)PYRENE	MG/KG		0.37	0.536 U	0.059 J	0.696 U	0.548 U
INDENO(1,2,3-c,d)PYRENE	MG/KG		12.73	0.536 U	0.062 J	0.696 U	0.548 U
BENZO(g,h,i)PERYLENE	MG/KG		12.73	0.536 U	0.054 J	0.696 U	0.548 U
Volatiles							
CARBON DISULFIDE	MG/KG		19.00	0.001 J	0.011 U	0.006 J	0.006 J
BENZENE	MG/KG		0.002	0.0002 J	0.011 U	0.011 U	0.012 UJ

The risk-based concentrations are based on a hazard quotient (HQ) of 0.1 and an excess lifetime cancer risk of 10 -6.
BKG = background (2 times average) values from AFWTF Camp Garcia Western Perimeter Study (November 1999)
SSL = EPA Region III Soil Screening Level for Groundwater Migration (with a dilution factor (DAF) of 20

Table 5-4
Surface Water Analytical Data Summary
SWMU 6, NASD - Vieques, PR

StationID					W6-SW01	W6-SW02	W6-SW03	W6-SW04	W6-SW05	W6-SW06	W6-SW07
SampleID					NDA035	NDA036	NDA037	NDA039	NDA040	NDA300	NDA301
Date Collected		Ecological[1]		Human	04/13/2000 10:00	04/13/2000 9:30	04/13/2000 10:45	04/13/2000 13:30	04/13/2000 13:15	04/13/2000 14:30	04/13/2000 14:
Parameter	Units	Acute (A)	Chronic (C)	Health[2] (H)							
Total Metals											
ALUMINUM	MG/L				1.82 =	1.44 =	1.68 =	2.02 =	1.37 =	2.26 =	2.97 =
ARSENIC	MG/L	0.069	0.036	0.00014	0.0034 U	0.0038 J - - H	0.0034 U	0.0034 U	0.005 J - - H	0.0053 J - - H	0.0034 U
BARIUM	MG/L				0.0127 J	0.0119 J	0.0123 J	0.0135 J	0.0122 J	0.0138 J	0.0151 J
CADMIUM	MG/L	0.042	0.0093		0.0019 J	0.0019 J	0.002 J	0.002 J	0.002 J	0.0019 J	0.0019 J
CALCIUM	MG/L				476 J	463 J	464 J	465 J	470 J	469 J	487 J
CHROMIUM, TOTAL	MG/L				0.0011 J	0.0005 U	0.0011 J	0.00063 J	0.00058 J	0.0005 U	0.00051 J
COBALT	MG/L				0.0005 U	0.0005 U	0.0011 J	0.0005 U	0.0005 U	0.0005 U	0.00071 J
COPPER	MG/L	0.0029	0.0029		0.0019 U	0.0046 J A C -	0.0019 J	0.002 J	0.0022 J	0.005 J A C -	0.0019 U
IRON	MG/L				0.887 J	0.7 J	0.761 J	0.883 J	0.614 J	0.979 J	1.41 J
LEAD	MG/L	0.21	0.0081		0.0011 U	0.0016 J	0.0011 U	0.0012 J	0.0011 U	0.0147 = - C -	0.0017 J
MAGNESIUM	MG/L				1540 =	1540 =	1560 =	1560 =	1550 =	1560 =	1560 =
MANGANESE	MG/L			0.10	0.0257 J	0.0198 J	0.0181 J	0.0189 J	0.0053 J	0.0213 J	0.0308 J
MERCURY	MG/L	0.0018	0.000025	0.000051	0.00018 R	0.00018 R	0.0016 J - C H	0.00018 R	0.00018 R	0.00018 R	0.00018 R
NICKEL	MG/L	0.074	0.0082	4.60	0.0008 U	0.0011 J	0.0008 U	0.0008 U	0.0008 U	0.0008 U	0.00096 J
POTASSIUM	MG/L				0.0266 U	0.0266 U	0.0266 U	0.0266 U	412 =	0.0266 U	0.0266 U
SELENIUM	MG/L	0.29	0.071	11.00	0.0052 =	0.0056 =	0.0064 =	0.0027 J	0.0042 J	0.004 J	0.0038 J
SILVER	MG/L	0.0019	0.00023		0.0025 U	0.0025 U	0.0025 U	0.0025 U	0.0071 J A C -	0.0025 U	0.0025 U
SODIUM	MG/L				6500 J	6370 J	6520 J	6270 J	6200 J	6240 J	6330 J
THALLIUM	MG/L	0.213	0.0213	0.0063	0.0027 U	0.0049 J	0.0027 U	0.0027 U	0.0027 U	0.0027 U	0.0027 U
VANADIUM	MG/L				0.0033 J	0.0036 J	0.0025 J	0.004 J	0.0037 J	0.0045 J	0.0058 J
Semi-Volatiles											
DIETHYL PHTHALATE	MG/L	0.759	0.0759	120.00	0.0006 J	0.0005 J	0.0005 J	0.01 U	0.011 U	0.01 U	0.011 U

[1] "National Recommended Water Quality Criteria," USEPA 822-Z-99-001, April 1999 (Marine Surface Water)

[2] "National Recommended Water Quality Criteria," USEPA 822-Z-99-001, April 1999. (Consumption of Organisms)

Table 5-5
Sediment Analytical Data Summary
SWMU 6, NASD - Vieques, PR

			SQAG[1]		NOAA[2]								
StationID						W6-SD01	W6-SD02	W6-SD03	W6-SD04	W6-SD05	W6-SD06	W6-SD07
SampleID						NDA042	NDA043	NDA044	NDA045	NDA046	NDA302	NDA303
Collection Depth						0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5
Date Collected						04/13/2000 10:00	04/13/2000 9:30	04/13/2000 10:45	04/13/2000 13:30	04/13/2000 13:15	04/13/2000 14:30	04/13/2000 14:10
Parameter	Units	BKG	TEL (T)	PEL (P)	ERL (E)							
Metals												
ALUMINUM	MG/KG					8400 =	6890 =	19300 =	12300 =	14800 =	5680 =	17800 =
ANTIMONY	MG/KG	1.76				0.72 J	97.8 J E	0.85 J	0.5 UJ	0.56 UJ	0.14 UJ	0.62 UJ
ARSENIC	MG/KG	2.08	7.24	41.60	8.20	2.3 J	**555 = T P E**	5.9 J	5.8 J	5.2 J	1.1 J	4 J
BARIUM	MG/KG	167.17				5.1 J	571 =	14.7 J	10.7 J	11.9 J	17.3 J	14.4 J
BERYLLIUM	MG/KG	0.58				0.082 J	14.2 =	0.25 J	0.18 J	0.25 J	0.16 J	0.29 J
CADMIUM	MG/KG	0.35				0.033 U	13.7 =	0.094 U	0.072 U	0.081 U	0.02 U	0.088 U
CALCIUM	MG/KG					30100 =	55800 =	46100 =	38600 =	30100 =	1630 =	14600 =
CHROMIUM, TOTAL	MG/KG	45.92	52.30	160	81	32.4 =	**67.8 = T - -**	16.9 =	13.9 =	15.6 =	4.6 =	12.9 =
COBALT	MG/KG	39.41				6.2 J	142 =	6.9 J	6.1 J	6.5 J	1.7 J	7.3 J
COPPER	MG/KG	147.78	18.70	108	34	**22.8 = T - -**	**101 = T - E**	**37.8 = T - E**	**29.8 = T - -**	**34.4 = T - E**	9.1 =	**28.9 = T - -**
IRON	MG/KG	9360.00				13100 =	10500 =	25700 =	21900 =	23900 =	5110 =	22400 =
LEAD	MG/KG	4.19	30.20	112.00	46.70	3.1 =	**144 = T P E**	21.8 =	13.8 =	14.2 =	1.5 =	8.3 =
MAGNESIUM	MG/KG					6340 =	5260 =	11600 =	8590 =	9710 =	2670 =	9840 =
MANGANESE	MG/KG	2516.77				133 =	277 =	237 =	226 =	237 =	30.2 =	225 =
MERCURY	MG/KG	0.04				0.18 J E	0.21 J E	0.05 UJ	0.052 UJ	0.047 UJ	0.0087 UJ	0.052 UJ
NICKEL	MG/KG	32.18	15.90	42.80	20.90	12.6 J	**143 = T P E**	6.1 J	4.9 J	5.4 J	1.8 J	4.8 J
POTASSIUM	MG/KG					1930 =	1290 J	6550 =	4530 =	5540 =	2070 =	6250 =
SELENIUM	MG/KG	1.85				0.35 U	544 =	2.2 J	0.96 J	1.3 J	0.8 J	1.4 J
SILVER	MG/KG					0.083 U	14.5 = E	0.24 U	0.18 U	0.2 U	0.05 U	0.22 U
SODIUM	MG/KG					11100 =	7190 =	45700 =	32200 =	38600 =	8900 =	41000 =
THALLIUM	MG/KG					0.45 U	572 =	1.4 J	0.97 U	1.1 U	0.27 U	1.2 U
VANADIUM	MG/KG	169.89				30.5 =	174 =	50.9 =	35 J	40.1 J	23.5 =	45.7 =
ZINC	MG/KG	132.11	124.00	271.00	150.00	26.1 =	**173 = T - E**	67.5 =	60.5 =	59.2 =	12.9 =	53.2 =
Pesticides												
p,p'-DDE	MG/KG					0.0055 U	0.00081 J	0.016 UJ	0.012 UJ	0.013 UJ	0.0083 UJ	0.015 UJ
Volatiles												
CARBON DISULFIDE	MG/KG					0.003 J	0.003 J	0.022 J	0.013 J	0.015 J	0.008 J	0.02 J
METHYL ETHYL KETONE	MG/KG					0.004 J	0.004 J	0.017 J	0.036 R	0.012 J	0.026 R	0.012 J
TOLUENE	MG/KG					0.012 U	0.011 U	0.003 J	0.003 J	0.003 J	0.026 UJ	0.003 J
ETHYLBENZENE	MG/KG					0.012 U	0.011 U	0.002 U	0.001 J	0.002 J	0.026 UJ	0.001 J
M,P-XYLENE	MG/KG					0.0003 J	0.011 U	0.013 J	0.008 J	0.01 J	0.026 UJ	0.005 J
O-XYLENE	MG/KG					0.012 U	0.011 U	0.003 J	0.002 J	0.003 J	0.026 UJ	0.002 J
XYLENES, TOTAL	MG/KG				0.05	0.0003 J	0.011 U	0.016 J	0.01 J	0.013 J	0.026 UJ	0.007 J

Sources:

[1] *Development of an Approach to the Assessment of Sediment Quality in Florida Coastal Waters.*
Volume I - Development and Evaluation of Sediment Quality Assessment Guidelines.
Florida Department of Environmental Protection. November 1994.

[2] National Oceanic and Atmospheric Administration (NOAA) guidelines from *Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments*. E.R. Long et al. 1995

Abbreviations:
PEL - Probable Effects Level
TEL - Threshold Effects Level
ERL - Effects Range - Low

SECTION 6

SWMU 07 Quebrada Disposal Site

This section presents the results of the Expanded PA/SI investigation performed at SWMU 07 – Quebrada Disposal Site at NASD, Vieques, Puerto Rico. The field sampling activities associated with this investigation were performed by CH2M HILL in April and May 2000.

This section includes a description of the objectives of the Expanded PA/SI, a site description, results of previous investigations, summary of field activities, summary of laboratory results, and conclusions and recommendations. To evaluate the potential for environmental impacts from the site, data were compared to applicable regulatory screening and background values. A description of the environmental screening process was presented in Section 2.14 of this report.

6.1 Objectives

The specific objectives of this investigation were to:

1. Determine if a release of hazardous materials has occurred as a result of site-related activities; and
2. Assess whether the site is a candidate for closeout as a NFRAP site; or
3. Determine if further investigation or evaluation are warranted at this SWMU.

6.2 Site Description

The Quebrada Disposal Site encompasses an area of approximately 1 acre. The landfill site was used between the early 1960s and late 1970s.

The Quebrada varies from 20 to 30 feet wide and 10 to 20 feet deep. More than 1,500 cubic yards (500 feet x 20 feet x 4 feet) of material are estimated to be present at the site (IAS, 1984).

6.2.1 Summary of Qualitative Ecological Survey

The physical setting of this site consists of a gently sloping upland area adjacent to the creek and the very steep embankments associated with the creek (quebrada) which drains to the north to the Caribbean Sea. Historically, portions of this site were cleared, but have been abandoned long enough for a shrub plant community to re-establish within the upland area. This plant community consists of shrub and tree canopy layers, which provided nearly 100 percent cover. The dominant shrubs in this community consist of *Leucaena leucocephala, Foresteria eggersiana,* and *Acacia retusa*. There was a lower density of trees in the area and tree species such as *Andira inermis* and *Cordia collococca* were the dominant species observed in the plant community. The dense canopy has precluded the development of a herbaceous stratum. *Lasiacis divaricata* was present in scattered areas. No vegetation stresses were observed at SWMU 7.

During the wildlife survey conducted on this site, a few wildlife species such as red-tailed hawk, bananaquit, adelaidae warbler, green-throated carib, pearly-eyed thrasher, northern mockingbird, puerto rican lizard cuckoo, louisiana waterthrush, loggerhead kingbird, gray kingbird, white-winged dove, and anolis lizards were observed utilizing the habitat. There were no federally protected species or preferred habitat observed at this site. The bird species observed consisted of coastal forest and shore species due to the close proximity to Caribbean Sea. Numerous anolis lizards were also observed at this site. There was no evidence that the SWMU site has had an impact on the wildlife or its habitat.

6.3 Previous Investigation Results

In April 1988, ESE prepared a Confirmation Study to determine possible dispersion and migration of specific chemicals at Roosevelt Roads and NASD, Vieques, for the Atlantic Division, Naval Facilities Engineering Command (ESE, 1988). The objective of this Confirmation Study was to determine whether specific toxic or hazardous materials have contaminated the environment as a result of Navy activities. The results of this study are summarized below.

6.3.1 Groundwater

Three monitoring wells were installed and sampled for pH, priority pollutants, oil and grease, VOCs, methyl ethyl ketone, methyl isobutyl ketone, ethylene dibromide, chromium

(total and hexavalent), xylene, and lead. Results from the groundwater analysis showed that metals concentrations exceeded drinking water criteria and ambient water quality criteria. It was assumed that the groundwater data was analyzed for total (unfiltered) metals. This information, however, was not apparent in the report.

6.3.2 Soils

A total of six soil samples and three sediment samples were analyzed for pH, oil and grease, VOCs, methyl ethyl ketone, methyl isobutyl ketone, ethylene dibromide, chromium (total and hexavalent), xylene, and lead. Soil and sediment sampling showed no elevated levels of any of constituents of concern for this site.

6.4 Expanded PA/SI Field Investigations

The Expanded PA/SI for SWMU 07 was conducted in April 2000 and included re-sampling of one existing monitoring well, installation and sampling of two new monitoring wells, and resampling of six surface soil locations and three sediment locations. All samples were analyzed for metals, VOCs, SVOCs, pesticides, PCBs, and explosives. Figure 6-1 is a site map of SWMU 07 showing the groundwater, soil, and sediment sampling locations.

6.4.1 Groundwater Sampling

The sampling plan called for resampling of the three existing monitoring wells installed at the site as part of the previous investigation. However, existing monitoring wells SWMU 07 - MW02 and SWMU 07 - MW03 could not be located. These wells were replaced.

Prior to sampling, depth to groundwater were measured using an electronic water level indicator. These data was used in conjunction with the survey data to determine elevations of groundwater at the monitoring well. As shown in Figure 6-2, the groundwater flow direction is to the southwest. Based on the groundwater flow direction, MW01 is the upgradient well at the site.

6.4.2 Soil Sampling

Six surface soil samples were collected near the locations of the six surface samples collected during previous investigations.

6.4.3 Sediment Sampling

Three sediment samples were collected within the quebrada near the locations of the three surface samples collected during previous investigations. The quebrada was dry during the sampling and appeared to be dry except during periods of heavy rains.

6.5 Field Screening Results

Soil samples were screened in the field for VOCs using an OVM. This field screening method provides a qualitative evaluation of potential organic constituents in soil. The OVM results for the site are summarized in Appendix B. The results indicate that all OVM readings were 0.0 ppm for soil samples collected at SWMU 07, indicating that no release of organic constituents had occurred at this site.

6.6 Laboratory Analytical Results

The following section presents the interpretation of the analytical data from the SWMU 07 Expanded PA/SI investigation. The discussion includes the identification of screening/regulatory criteria exceedances, as well as exceedances of upgradient, background, and offsite concentrations for the individual media sampled. Conclusions and recommendations, by media, are presented in Section 6.6.

Concentrations of detected chemicals were compared to the following current USEPA screening criteria for each matrix:

- Residential and industrial RBCs and soil screening level criteria for soil;
- Tap water RBCs and drinking water MCLs for groundwater;
- SQAG and NOAA screening values for sediment.

Preliminary background soils criteria were obtained from data collected from Camp Garcia.

Appendix I contains a compilation of the concentrations for all chemicals for which samples were analyzed. Appendix J contains a data validation summary.

6.6.1 Groundwater Results

Analytical results from unfiltered (total metals) samples indicate detections of aluminum, antimony, arsenic, iron, manganese, vanadium, and zinc in groundwater samples at

concentrations exceeding the MCLs and/or RBCs. Filtered metals (dissolved) results show detections of aluminum, iron, manganese, and vanadium above the MCLs and/or RBCs.

These metals were detected in all wells, including upgradient monitoring well SWMU07-MW01, at relatively similar concentrations, indicating that the detections are likely indicative of background conditions and are not site-related.

VOCs, SVOCs, pesticides, PCBs, and explosives were either not detected, or were detected at concentrations below their applicable screening criteria. Table 6-1 summarizes groundwater detections, which are presented graphically on Figure 6-3.

6.6.2 Surface Soil Results

Analytical results indicate detections of aluminum, arsenic, chromium, copper, iron, lead, manganese, thallium, vanadium, benzo(a)pyrene, and acetone in surface soil at concentrations above the residential RBC and/or leachability criteria.

The metals were detected in all samples at relatively similar concentrations, indicating that the detections are likely indicative of background conditions and are not site-related. Benzo(a)pyrene was detected in two surface soil samples at low concentrations slightly exceeding the residential RBC. Acetone was detected in two surface soil samples above the leachability criteria. Acetone is a common laboratory contaminant in soil, however, because it is used for the extraction process.

Pesticides, PCBs, and explosives were either not detected, or were detected at concentrations below their applicable screening criteria Table 6-2 summarizes the surface soil detections, which are presented graphically on Figure 6-4.

6.6.3 Sediment

Several metals were detected in sediment samples at concentrations exceeding the ecological screening criteria. The metals were detected in all samples at relatively similar concentrations, indicating that the detections are likely indicative of background conditions and are not site-related.

VOCs, SVOCs, pesticides, PCBs, and explosives were either not detected, or were detected at concentrations below their applicable screening criteria. Table 6-3 summarizes the surface soil detections, which are presented graphically on Figure 6-5.

6.7 Conclusions and Recommendations

This section summarizes the results of the Expanded PA/SI activities by media, and provides recommendations for each media sampled.

6.7.1 Groundwater

Metals were detected in groundwater samples at concentrations indicative of site background levels. All other parameters were either not detected, or were detected below the applicable screening criteria. No evidence exists to suggest that a release of hazardous materials to surface soil has occurred at this site as a result of site-related activities. As a result, no additional groundwater investigations are recommended. However, a risk assessment should be conducted for constituents detected in the groundwater above risk based criteria.

6.7.2 Surface Soil

Metals were detected in surface soil samples at concentrations indicative of site background levels. Acetone was detected in two surface soil samples at relatively low concentrations, but these detections are believed to be the result of laboratory contamination. Benzo(a)pyrene was detected in two surface soil samples at relatively low concentrations. Benzo(a)pyrene was the only constituent detected that may be present as a result of site-related activities.

All other parameters were either not detected, or were detected below the applicable screening criteria. Additional surface soil sampling through the Full RI/FS process is recommended to delineate the extent of benzo(a)pyrene. A risk assessment should be conducted for constituents detected in the soil above risk based criteria. In addition, a soil background investigation is recommended to verify the range of background concentrations of metals within the soils of NASD.

6.7.3 Sediment

Metals were detected in sediment samples at concentrations indicative of site background levels. All other parameters were either not detected, or were detected below the applicable screening criteria. No evidence exists to suggest that a release of hazardous materials to sediment has occurred at this site as a result of site-related activities. Therefore, no additional sediment sampling is recommended.

6.7.4 Institutional Controls

The site will be demarcated by using posts, chains, and signs along the roadway. The institutional controls will remain in place until the final CERCLA process is completed.

Table 6-1
Groundwater Analytical Data Summary
SWMU 7, NASD - Vieques, PR

StationID					SWMU7-MW01	SWMU7-MW02R	SWMU7-MW03R
SampleID					NDA010	NDA011	NDA012
Date Collected		Screening Criteria			05/02/2000 15:15	05/02/2000 13:10	05/02/2000 10:50
Paramater Name	Units	BKG	Federal MCL (M)	Tapwater RBC (T)			
Dissolved Metals							
ALUMINUM, DISSOLVED	MG/L		0.05	3.65	0.0258 U	0.0531 J M -	0.0258 U
ARSENIC, DISSOLVED	MG/L	0.01	0.05	0.00004	0.0084 J	0.0034 U	0.0034 U
BARIUM, DISSOLVED	MG/L	0.28	2.00	0.26	0.0925 J	0.2 J	0.0547 J
CALCIUM, DISSOLVED	MG/L				62.8 =	198 =	59.7 =
CADMIUM, DISSOLVED	MG/L	0.004	0.005	0.002	0.0002 U	0.0008 J	0.00035 J
CHROMIUM, DISSOLVED	MG/L	0.02	0.10	0.11	0.00069 J	0.0013 J	0.0017 J
COBALT, DISSOLVED	MG/L	0.02		0.22	0.0015 J	0.0005 U	0.00067 J
IRON, DISSOLVED	MG/L		0.30	1.10	0.944 J M -	0.0705 J	0.0122 R
LEAD, DISSOLVED	MG/L		0.01		0.0011 U	0.0017 J	0.0011 U
MAGNESIUM, DISSOLVED	MG/L				62.7 =	99 =	42.9 =
MANGANESE, DISSOLVED	MG/L		0.05	0.07	1.09 = M T	0.022 =	0.0311 =
NICKEL, DISSOLVED	MG/L	0.02	0.10	0.07	0.005 J	0.0012 J	0.0018 J
POTASSIUM, DISSOLVED	MG/L				2.28 J	3.52 J	2 J
SELENIUM, DISSOLVED	MG/L	0.02	0.05	0.02	0.0021 U	0.0021 U	0.0023 J
SILVER, DISSOLVED	MG/L				0.0005 U	0.0005 U	0.00079 J
SODIUM, DISSOLVED	MG/L				316 =	243 =	257 =
VANADIUM, DISSOLVED	MG/L	0.04		0.03	0.0035 J	0.0176 J	0.0355 J - T
ZINC, DISSOLVED	MG/L	0.14	5.00	1.10	0.01 J	0.0066 J	0.0041 J
Total Metals							
ALUMINUM	MG/L		0.05	3.65	1.26 = M -	0.672 = M -	4.09 = M T
ANTIMONY	MG/L		0.01	0.001	0.0015 J - T	0.0014 U	0.0014 U
ARSENIC	MG/L	0.01	0.05	0.00004	0.0272 = - T	0.0034 U	0.0034 U
BARIUM	MG/L	0.28	2.00	0.26	0.102 J	0.212 =	0.0642 J
CADMIUM	MG/L	0.004	0.005	0.002	0.00052 J	0.00064 J	0.00021 J
CALCIUM	MG/L				74 =	194 =	67.8 =
CHROMIUM, TOTAL	MG/L	0.02	0.10	0.11	0.0294 =	0.004 J	0.0092 J
COBALT	MG/L	0.02		0.22	0.0131 J	0.0005 U	0.0021 J
COPPER	MG/L	0.04	1.00	0.15	0.0183 J	0.0026 J	0.007 J
IRON	MG/L		0.30	1.10	7.32 J M T	1.46 J M T	4.17 J M T
LEAD	MG/L		0.01		0.0095 =	0.0014 J	0.0011 U
MAGNESIUM	MG/L				68 =	95.3 =	47.1 =
MANGANESE	MG/L		0.05	0.07	1.27 = M T	0.0731 = M T	0.148 = M T
NICKEL	MG/L	0.02	0.10	0.07	0.0186 J	0.0024 J	0.0049 J
POTASSIUM	MG/L				2.77 J	3.56 J	2.32 J
SELENIUM	MG/L	0.02	0.05	0.02	0.0021 U	0.0032 J	0.0036 J
SODIUM	MG/L				322 =	239 =	252 =
VANADIUM	MG/L	0.04		0.03	0.0163 J	0.0198 J	0.0462 J - T
ZINC	MG/L	0.14	5.00	1.10	2.95 = - T	0.0059 J	0.0119 J
Miscellaneous							
PERCHLORATE	MG/L				0.0008 U	0.0008 U	0.0024 J
Volatiles							
ACETONE	MG/L			0.06	0.01 =	0.005 U	0.005 U

Table 6-2
Surface Soil Analytical Data Summary
SWMU-07, NASD - Vieques, PR

StationID						W7-SB01	W7-SB02	W7-SB03	W7-SB04	W7-SB05	W7-SB06
SampleID						NDA119	NDA120	NDA121	NDA122	NDA123	NDA124
Collection Depth						0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5
Date Collected						04/18/2000 9:15	04/18/2000 9:40	04/18/2000 10:30	04/18/2000 10:50	04/18/2000 13:30	04/18/2000 13:55
Parameter	Units	BKG	Industrial RBC (I)	Residential RBC RBC-R (R)	SSL (L)						
ALUMINUM	MG/KG		204400.00	7821.43		**18900** = - R -	**18400** = - R -	**11100** = - R -	**11200** = - R -	**16900** = - R -	**13200** = - R -
ANTIMONY	MG/KG	1.76	81.76	3.13	13.20	0.33 J	0.28 J	0.15 UJ	0.35 J	0.24 J	0.19 J
ARSENIC	MG/KG	2.08	3.82	0.43	0.03	0.39 U	0.46 U	**6.6** = I R L	**0.47** J - R L	**0.76** J - R L	**0.5** J - R L
BARIUM	MG/KG	167.17	14308.00	547.50	2105.32	97.1 J	90.5 J	63.2 J	62.7 J	85.6 J	111 J
BERYLLIUM	MG/KG	0.58	408.80	15.64	1153.69	0.4 J	0.37 J	0.26 J	0.26 J	0.36 J	0.3 J
CALCIUM	MG/KG					6700 =	7170 =	5010 =	9330 =	6540 =	6970 =
CHROMIUM, TOTAL	MG/KG	45.92	450.00	210.00	40.00	**91.9** = - - L	**75.7** = - - L	**53** = - - L	39.8 =	**66** = - - L	**43.6** = - - L
COBALT	MG/KG	39.41	12264.00	469.29		30.8 =	24.2 =	18.1 =	12 =	20.9 =	19.2 =
COPPER	MG/KG	147.78	8176.00	312.86	10517.84	**1250** = - R -	44.6 =	51.3 =	38.8 =	52.7 =	38.6 =
IRON	MG/KG	9360.00	61320.00	2346.43		**33000** = - R -	**31400** = - R -	**50300** = - R -	**22600** = - R -	**42700** = - R -	**28000** = - R -
LEAD	MG/KG	4.19	100.00	40.00		24.4 =	13.7 =	**43.6** = - R -	**42.9** = - R -	**98.7** = - R -	10.6 =
MAGNESIUM	MG/KG					7330 =	7140 =	3910 =	4000 =	5430 =	5250 =
MANGANESE	MG/KG	2516.77	4088.00	1600.00	950.00	**1110** = - - L	855 =	759 =	599 =	844 =	**1060** = - - L
MERCURY	MG/KG	0.04	61.32	2.35	2.10	0.037 J	0.028 J	0.024 J	0.03 J	0.042 J	0.025 J
NICKEL	MG/KG	32.18	4088.00	156.43	100.00	42.7 =	38.1 =	25.1 =	16.2 =	24.8 =	23.1 =
POTASSIUM	MG/KG					681 J	1340 J	1210 =	1270 =	1320 =	1210 =
SELENIUM	MG/KG	1.85	1022.00	39.11	18.98	0.34 J	0.28 U	0.23 U	0.29 J	0.23 U	0.24 U
SILVER	MG/KG		1022.00	39.11	31.03	0.071 J	0.068 U	0.14 J	0.057 J	0.59 J	0.063 J
SODIUM	MG/KG					137 J	193 J	83 J	144 J	186 J	229 J
THALLIUM	MG/KG		14.31	0.55	3.64	**1.3** J - R -	**0.99** J - R -	**2** J - R -	0.5 J	**1** J - R -	**0.65** J - R -
VANADIUM	MG/KG	169.89	1430.80	54.75	5111.02	**130** = - R -	**115** = - R -	**89.5** = - R -	**71.2** = - R -	**109** = - R -	**98.7** = - R -
ZINC	MG/KG	132.11	61320.00	2346.43	13621.80	104 =	419 =	124 =	274 =	200 =	197 =
p,p'-DDE	MG/KG		16.83	1.88	35.22	0.0037 UJ	0.0044 UJ	0.0036 UJ	0.0099 J	0.0023 J	0.0004 J
p,p'-DDT	MG/KG		16.83	1.88	1.16	0.002 J	0.0007 J	0.0036 UJ	0.023 J	0.016 J	0.0036 J
PHENANTHRENE	MG/KG			234.64	682.00	0.503 UJ	0.541 UJ	0.409 UJ	0.45 UJ	0.034 J	0.432 UJ
ANTHRACENE	MG/KG		61320.00	2346.43	465.60	0.503 UJ	0.541 UJ	0.03 J	0.45 UJ	0.032 J	0.432 UJ
FLUORANTHENE	MG/KG		8176.00	312.86	6254.64	0.503 UJ	0.541 UJ	0.222 J	0.155 J	0.558 J	0.041 J
PYRENE	MG/KG		6132.00	234.64	682.00	0.503 UJ	0.541 UJ	0.255 J	0.128 J	0.626 J	0.035 J
BENZO(a)ANTHRACENE	MG/KG		7.84	0.87	1.46	0.503 UJ	0.541 UJ	0.238 J	0.09 J	0.327 J	0.033 J
CHRYSENE	MG/KG		784.00	87.50	146.09	0.503 UJ	0.541 UJ	0.247 J	0.102 J	0.43 J	0.035 J
bis(2-ETHYLHEXYL) PHTHALATE	MG/KG			46.00	2900.00	0.503 UJ	0.919 J	0.409 UJ	0.45 UJ	0.45 UJ	0.432 UJ
BENZO(b)FLUORANTHENE	MG/KG		7.84	0.87	4.51	0.503 UJ	0.541 UJ	0.27 J	0.063 J	0.387 J	0.03 J
BENZO(k)FLUORANTHENE	MG/KG		78.40	8.75	45.14	0.503 UJ	0.541 UJ	0.223 J	0.064 J	0.312 J	0.034 J
BENZO(a)PYRENE	MG/KG		0.78	0.09	0.37	0.503 UJ	0.541 UJ	**0.215** J - R -	0.073 J	**0.337** J - R -	0.033 J
INDENO(1,2,3-c,d)PYRENE	MG/KG		7.84	0.87	12.73	0.503 UJ	0.541 UJ	0.095 J	0.052 J	0.199 J	0.432 UJ
DIBENZ(a,h)ANTHRACENE	MG/KG		0.78	0.09	1.39	0.503 UJ	0.541 UJ	0.029 J	0.45 UJ	0.039 J	0.432 UJ
BENZO(g,h,i)PERYLENE	MG/KG			0.87	12.73	0.503 UJ	0.541 UJ	0.068 J	0.038 J	0.152 J	0.432 UJ
CARBAZOLE	MG/KG		286.16	31.94	0.47	0.503 UJ	0.541 UJ	0.409 UJ	0.45 UJ	0.036 J	0.432 UJ
ACETONE	MG/KG			780.00	2.50	0.149 R	0.023 R	0.487 R	0.012 R	**2.51** J - - L	**5.07** J - - L
2-HEXANONE	MG/KG			310.00		0.003 J	0.016 U	0.01 U	0.012 U	0.002 J	0.011 U

The risk-based concentrations are based on a hazard quotient (HQ) of 0.1 and an excess lifetime cancer risk of 10 -6.
BKG = background (2 times average) values from AFWTF Camp Garcia Western Perimeter Study (November 1999)
Industrial RBC = EPA Region III Risk Based Concentration for Soil (Industrial)
Residential RBC = EPA Region III Risk Based Concentration for Soil (Residential)
SSL = EPA Region III Soil Screening Level for Groundwater Migration (with a dilution factor (DAF) of 20

Table 6-3
Sediment Analytical Data Summary
SWMU 7, NASD - Vieques, PR

StationID			SQAG[1]		NOAA[2]	W7-SD01	W7-SD02	W7-SD03
SampleID						NDA047	NDA048	NDA049
Collection Depth						0 To 0.5	0 To 0.5	0 To 0.5
Date Collected						04/18/2000 9:55	04/18/2000 14:15	04/18/2000 14:30
Parameter	Units	BKG	TEL (T)	PEL (P)	ERL (E)			
Metals								
ALUMINUM	MG/KG					13200 J	13200 J	13200 J
ANTIMONY	MG/KG	1.76				0.15 UJ	0.24 J	0.15 UJ
ARSENIC	MG/KG	2.08	7.24	41.60	8.20	0.63 J	0.65 J	0.37 U
BERYLLIUM	MG/KG	0.58				0.23 J	0.23 J	0.23 J
CALCIUM	MG/KG					5210 J	6890 J	4700 J
CHROMIUM, TOTAL	MG/KG	45.92	52.30	160	81	**67 = T - -**	41.5 =	38.2 =
COBALT	MG/KG	39.41				30.3 J	**42.4 J E**	15.3 J
COPPER	MG/KG	147.78	18.70	108	34	**37.1 = T - E**	**34.8 = T - E**	**30.2 = T - -**
IRON	MG/KG	9360.00				26300 J	28000 J	25200 J
LEAD	MG/KG	4.19	30.20	112.00	46.70	3.9 J	4.1 J	1.7 J
MAGNESIUM	MG/KG					6020 J	5510 J	4370 J
MERCURY	MG/KG	0.04				0.016 J	0.014 U	0.013 U
NICKEL	MG/KG	32.18	15.90	42.80	20.90	**35.8 = T - P**	**20 = T - -**	14.2 =
POTASSIUM	MG/KG					1390 J	1460 J	1070 J
SELENIUM	MG/KG	1.85				0.23 U	0.37 J	0.23 U
SODIUM	MG/KG					111 J	145 J	71.7 J
THALLIUM	MG/KG					0.68 J	0.31 U	0.83 J
VANADIUM	MG/KG	169.89				106 J	111 J	91.7 J
ZINC	MG/KG	132.11	124.00	271.00	150.00	30.4 =	53.7 =	32.7 =

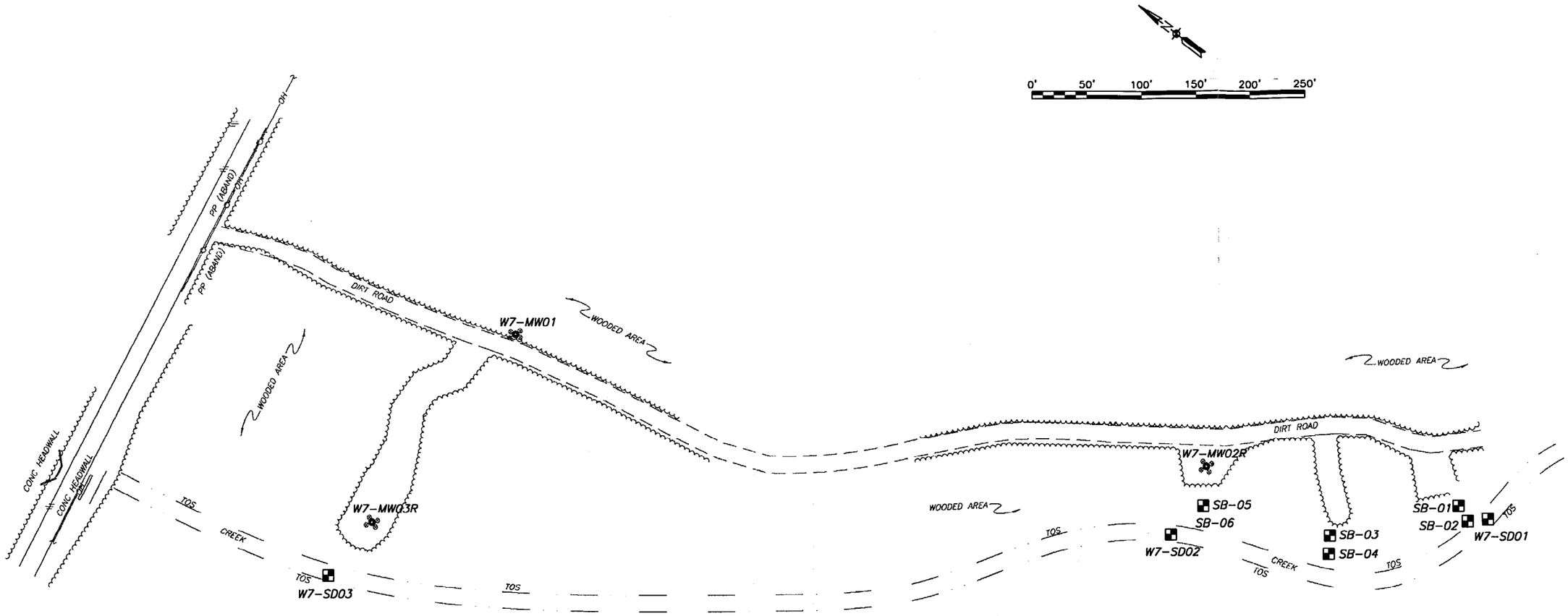
Sources:

[1] *Development of an Approach to the Assessment of Sediment Quality in Florida Coastal Waters,* Volume I - Development and Evaluation of Sediment Quality Assessment Guidelines. Florida Department of Environmental Protection. November 1994.

[2] National Oceanic and Atmospheric Administration (NOAA) guidelines from *Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments.* E.R. Long et al. 1995

Abbreviations:

PEL - Probable Effects Level
TEL - Threshold Effects Level
ERL - Effects Range - Low



LEGEND

BITUMINOUS PAVEMENT	
TOE OF SLOPE	TOS
OVERHEAD POWER	OH
BOLLARD	⊗
POWER POLE	⌀
GUY WIRE	⟶
MONITORING WELL	✪
SOIL BORING	SB-01

Figure 6-1 SWMU-7
Sample Locations
Naval Ammunition Support Detachment, Vieques Island

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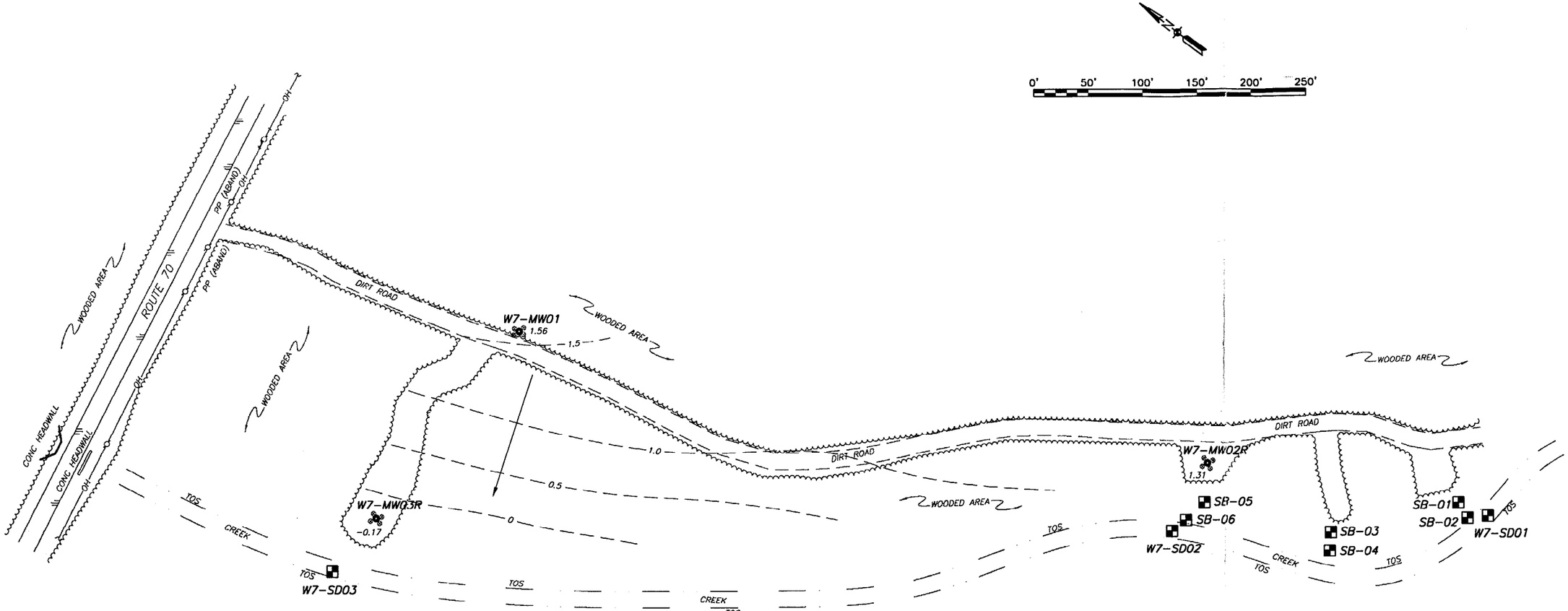

LEGEND

BITUMINOUS PAVEMENT	
TOE OF SLOPE	TOS
OVERHEAD POWER	OH
BOLLARD	⊗
POWER POLE	☼
GUY WIRE	⟶
MONITORING WELL	●
SOIL BORING	SB-01
GROUNDWATER ELEVATION (FEET MSL) MSL = MEAN SEA LEVEL	-1.54
GROUNDWATER CONTOUR CONTOUR INTERVAL 0.5 FEET	1.5
GROUNDWATER FLOW DIRECTION	

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Figure 6-2 SWMU-7
Groundwater Flow
Naval Ammunition Support Detachment, Vieques Island

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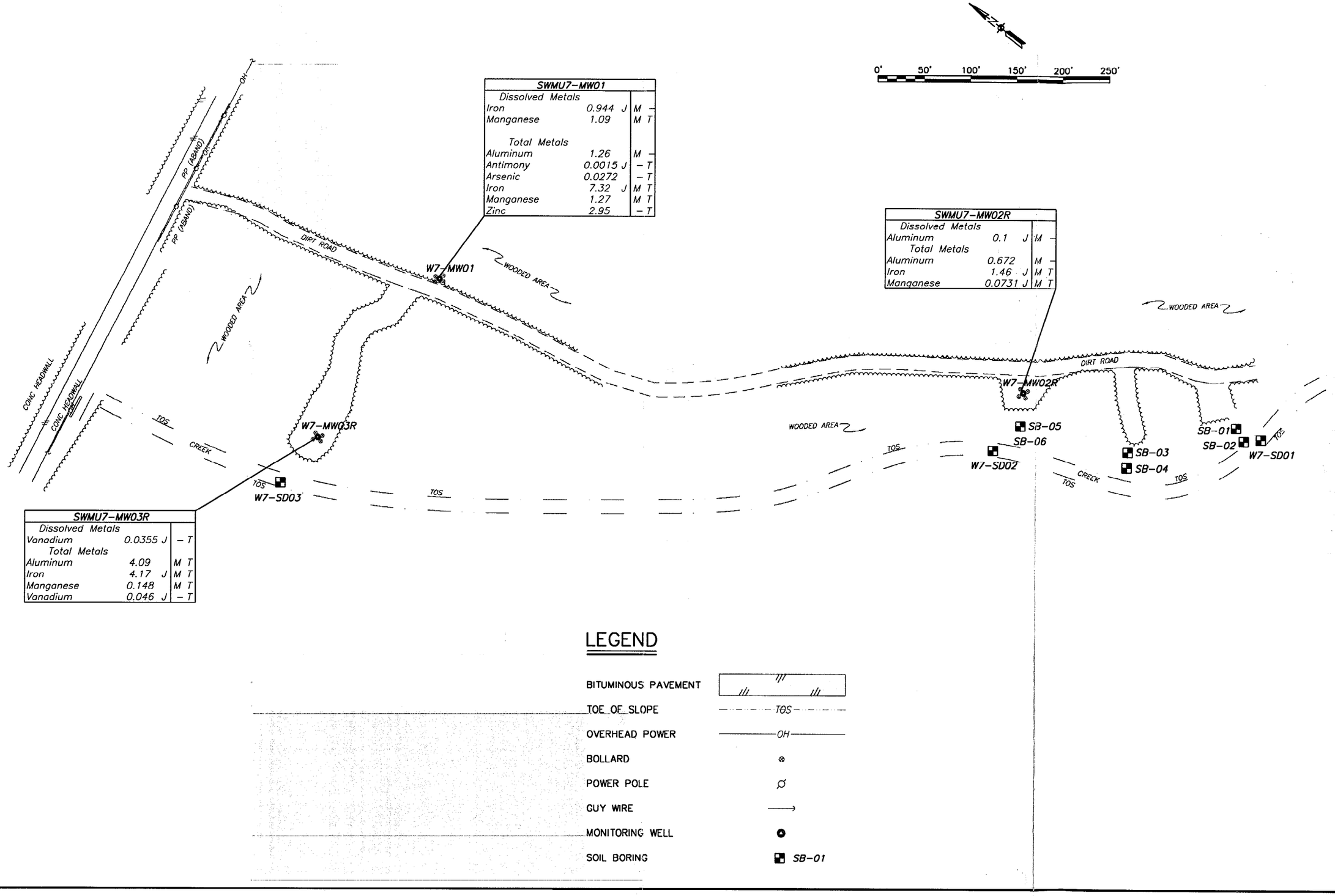

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Figure 6-3 SWMU-7
Ground Water Detections Above Screening Criteria
Naval Ammunition Support Detachment, Vieques Island

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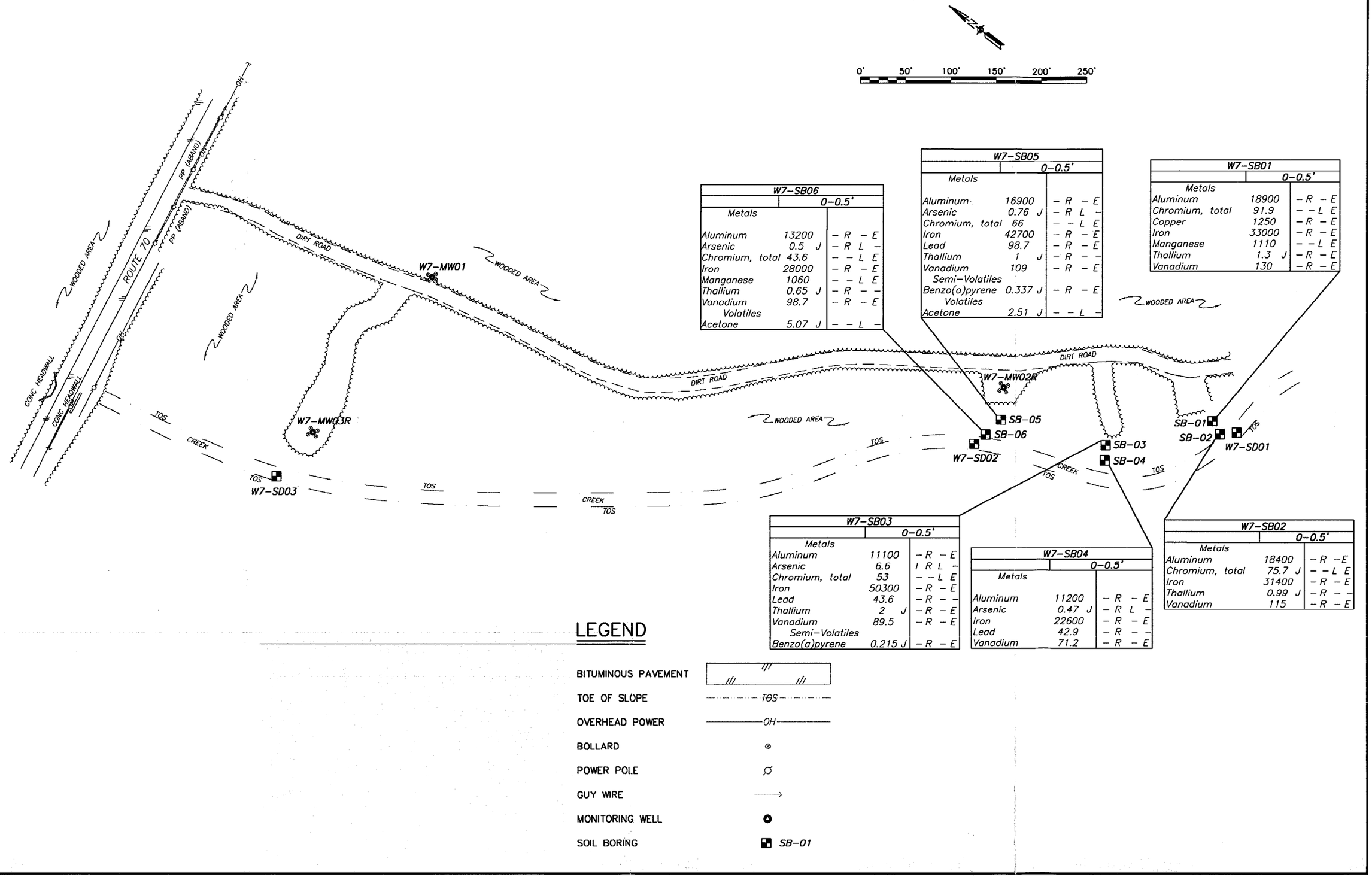

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Figure 6-4 SWMU-7
Soil Detections Above Screening Criteria
Naval Ammunition Support Detachment, Vieques Island

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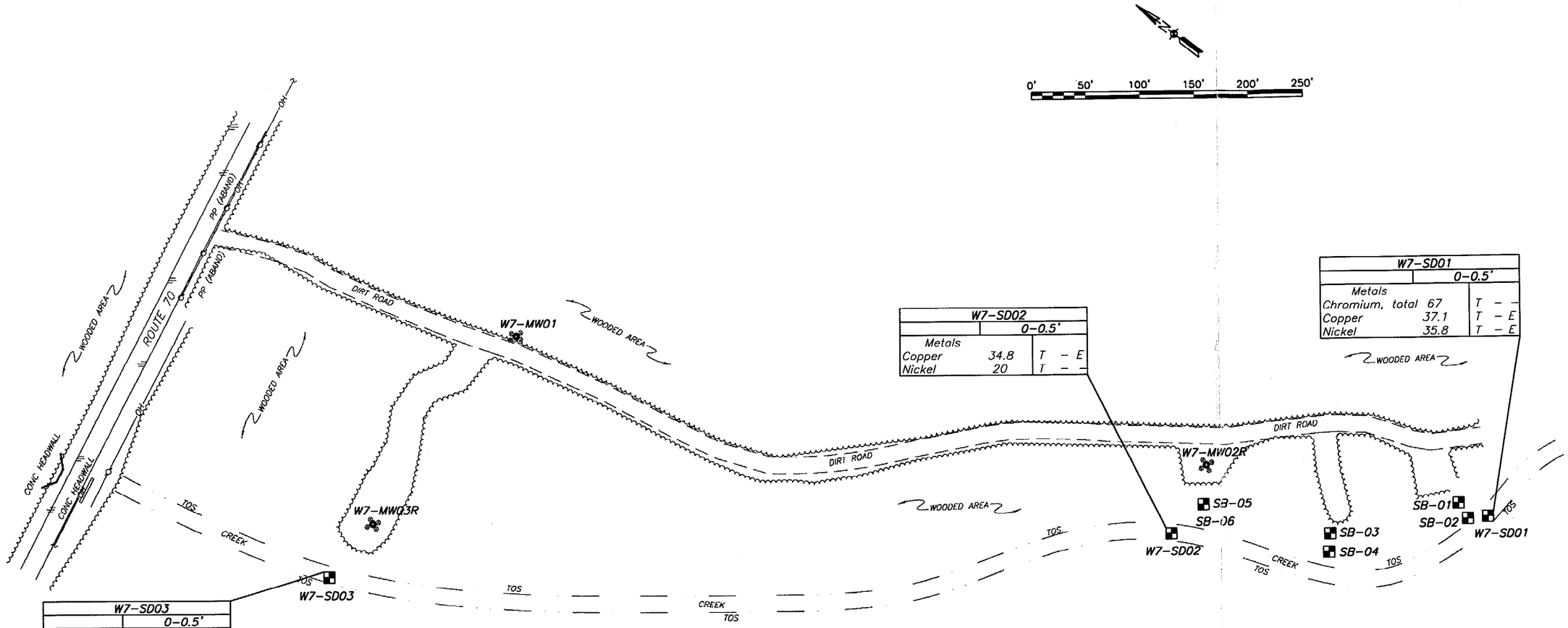

LEGEND

- BITUMINOUS PAVEMENT
- TOE OF SLOPE — TOS
- OVERHEAD POWER — OH
- BOLLARD
- POWER POLE
- GUY WIRE
- MONITORING WELL
- SOIL BORING — SB-01

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Figure 6-5 SWMU-7
Sediment Detections Above Screening Criteria
Naval Ammunition Support Detachment, Vieques Island

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SECTION 7

SWMU 10 Waste Paint and Solvents Disposal Site

This section presents the results of the Expanded PA/SI investigation performed at SWMU 10 – Waste Paint and Solvent Disposal Site at NASD, Vieques, Puerto Rico. The field sampling activities associated with this investigation were performed by CH2M HILL in April and May, 2000.

This section includes a description of the objectives of the Expanded PA/SI, a site description, results of previous investigations, summary of field activities, summary of laboratory results, and conclusions and recommendations. To evaluate the potential for environmental impacts from the site, data were compared to applicable regulatory screening and background values. A description of the environmental screening process was presented in Section 2.14 of this report.

7.1 Objectives

The specific objectives of this investigation were to:

1. Determine if a release of hazardous materials has occurred as a result of site-related activities; and
2. Assess whether the site is a candidate for closeout as a NFRAP site; or
3. Determine if further investigation or evaluation are warranted at this SWMU.

7.2 Site Description

The Waste Paint and Solvents Disposal Site consists of an area of soil outside the Paint Locker, Building 4001, where waste paints and solvents were allegedly spilled. SWMU 10 has been in use since the mid-1970s.

Waste paints and solvents have been recently transferred to NSRR for proper disposal.

7.2.1 Summary of Qualitative Ecological Survey

Grass and herbaceous species dominate this small site due to ongoing grounds maintenance activities (mowing) within the Public Works area. A few scattered shrubs are present in the general area but the ground cover was approximately 70 to 85 percent. The herbaceous plant community was dominated by *Digitaria ciliaris, Commelina erecta, Cynodon dactylon,* and *Bothriochloa ishaemum.*

Wildlife observed at this site is typical for developed grassed areas on Vieques. This site is very small and offers very limited habitat for any wildlife species. Occasional common passerine birds may frequent this area but to a very limited extent.

7.3 Previous Investigation Results

No previous sampling has been conducted at this site.

7.4 Field Investigations

Field investigations at SWMU 10 included the collection of 10 surface soil samples and 10 subsurface soil samples. The samples were analyzed for metals, VOCs, SVOCs, pesticides and PCBs. Figure 7-1 shows the soil sampling locations around Building 4001.

7.4.1 Soil Sampling

The 10 surface soil samples and 10 subsurface soil samples were collected at evenly spaced locations (approximately 20 feet apart) around the perimeter of the building. The surface soil samples were collected from zero to 6 inches bls, while subsurface soil samples were collected at a depth of 5 feet bls.

7.5 Field Screening Results

Soil samples were screened in the field for VOCs using an OVM. This field screening method provides a qualitative evaluation of potential organic constituents in soil. The OVM results for the site are summarized in Appendix B. The results indicate that the OVM readings ranged from 0.0 ppm to 0.5 ppm for soil samples collected at SWMU 10, indicating that no release of organic constituents had occurred at this site.

7.6 Laboratory Analytical Results and Risk Based Screening Analysis

The following section presents the interpretation of the analytical data from the SWMU 10 Expanded PA/SI investigation. The discussion includes the identification of screening/regulatory criteria exceedances as well as to background criteria. Conclusions and recommendations, by media, are presented in Section 7.6.

Concentrations of detected chemicals in soil were compared to USEPA residential and industrial RBCs and soil screening level criteria. Background criteria were obtained from data collected from Camp Garcia (Baker Environmental, Inc., November 1999).

Appendix J contains a compilation of the concentrations for all chemicals for which samples were analyzed. Appendix K contains a data validation summary.

7.6.1 Surface Soil Results

Analytical results indicate detections of aluminum, arsenic, iron, lead, and thallium in surface soil at concentrations above the residential RBC and/or leachability screening criteria. VOCs, SVOCs, pesticides, and PCBs were either not detected, or were detected at concentrations below their applicable screening criteria. Table 7-1 summarizes the surface soil detections, which are presented graphically on Figure 7-2.

The metals detected in surface soil were detected in all samples at relatively similar concentrations, indicating that the detections are likely indicative of background levels in soil at the site.

7.6.2 Subsurface Soil Results

Arsenic was detected above leachability criteria, but below background criteria. VOCs, SVOCs, pesticides, and PCBs were either not detected or were detected at concentrations below their applicable screening criteria. Table 7-2 summarizes subsurface soil screening results, which are shown graphically on Figure 7-2.

7.7 Conclusions and Recommendations

This section summarizes the results of the Expanded PA/SI activities by media, and provides recommendations for each media sampled.

7.7.1 Surface Soil

Metals were detected in surface soil samples at concentrations indicative of site background levels. All other parameters were either not detected, or were detected below the applicable screening criteria. No evidence exists to suggest that a release of hazardous materials to surface soil has occurred at this site as a result of site-related activities. A soil background investigation is recommended to characterize the range of metal concentrations in soils at NASD. Additionally, it is recommended that a Preliminary Risk Evaluation (PRE) be conducted to calculate the potential risk to human health presented by metals in surface soil at the site.

7.7.2 Subsurface Soil Samples

Arsenic was detected in subsurface soil at concentrations indicative of site background levels. All other parameters were either not detected, or were detected below the applicable screening criteria. No evidence exists to suggest that a release of hazardous materials to subsurface soil has occurred at this site as a result of site-related activities. An additional soil background investigation is recommended to characterize the range of metal concentrations in the soils at NASD. Additionally, it is recommended that a Preliminary Risk Evaluation (PRE) be conducted to calculate the potential risk to human health presented by metals in subsurface soil at the site.

7.7.3 Institutional Controls

The site will be demarcated by signs. The signs will remain until the CERCLA process is completed.

Table 7-1
Surface Soil Analytical Data Summary
SWMU-10, NASD - Vieques, PR

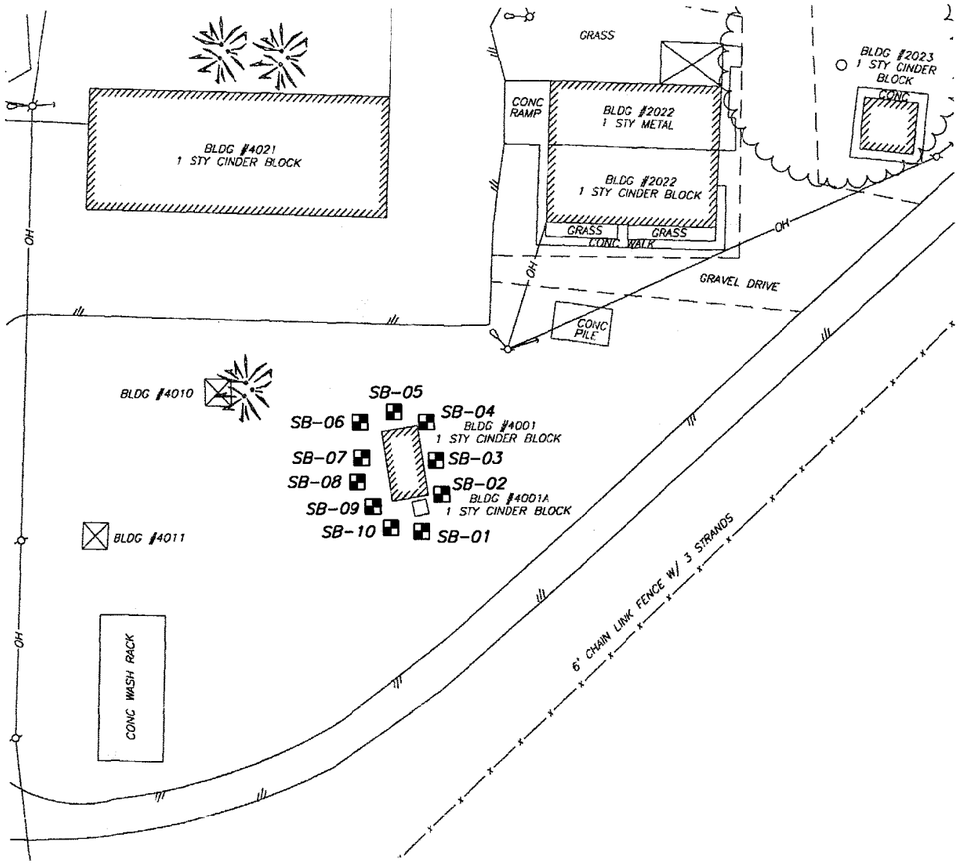
StationID		Screening Criteria				W10-SB01	W10-SB02	W10-SB03	W10-SB04	W10-SB05	W10-SB06	W10-SB07	W10-SB08	W10-SB09	W10-SB10
SampleID						NDA125	NDA127	NDA131	NDA133	NDA135	NDA137	NDA139	NDA141	NDA143	NDA145
Collection Depth			Industrial	Residential		0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5
Date Collected			RBC-I	RBC	SSL	04/04/2000 7:56	04/04/2000 9:00	04/04/2000 9:45	04/04/2000 10:10	04/04/2000 10:55	04/04/2000 10:32	04/04/2000 12:45	04/04/2000 12:55	04/04/2000 14:35	04/04/2000 14:55
Parameter	Units	2*BKG	(I)	(R)	(L)										
Metals															
ALUMINUM	MG/KG		204400.00	7821.43		6930 =	10000 = - R -	6460 =	7080 =	4610 =	4390 =	4130 =	3740 =	4070 =	4340 =
ANTIMONY	MG/KG	1.76	81.76	3.13	13.20	0.47 J	0.26 J	1.3 J	0.42 J	0.44 J	0.49 J	0.61 J	0.77 J	0.91 J	0.24 J
ARSENIC	MG/KG	2.08	3.82	0.43	0.03	1.1 J - R L	1.1 J - R L	1.4 J - R L	1.3 J - R L	1.4 J - R L	6.4 = I R L	2.8 = - R L	4.4 = I R L	0.7 J - R L	0.74 J - R L
BARIUM	MG/KG	167.17	14308.00	547.50	2105.32	65.8 =	94.4 =	299 =	96.4 =	77.1 =	115 =	114 =	110 =	105 =	65.5 =
BERYLLIUM	MG/KG	0.58	408.80	15.64	1153.69	0.14 J	0.19 J	0.14 J	0.11 J	0.14 J	0.13 J	0.14 J	0.13 J	0.13 J	0.14 J
CALCIUM	MG/KG					7330 =	4900 =	4110 =	6500 =	3450 =	1840 =	1630 =	1210 J	1150 =	1290 =
CHROMIUM, TOTAL	MG/KG	45.92	450.00	210.00	40.00	12.5 =	32.4 =	35.3 =	32.9 =	8.3 =	8.1 =	6.2 =	6.4 =	5.4 =	6 =
COBALT	MG/KG	39.41	12264.00	469.29		8.2 J	13.3 =	4.4 J	8.3 J	7.1 J	7 J	6.8 J	7.5 J	5.6 J	6.5 J
COPPER	MG/KG	147.78	8176.00	312.86	10517.84	35.1 =	35.4 =	66.9 =	49.7 =	52.3 =	86.8 =	51.2 =	43 =	35.6 =	18.4 =
IRON	MG/KG	9360.00	61320.00	2346.43		12500 = - R -	18200 = - R -	12900 = - R -	13000 = - R -	10100 = - R -	10300 = - R -	9250 = - R -	8830 = - R -	8190 = - R -	8830 = - R -
LEAD	MG/KG	4.19	100.00	40.00		16.4 =	17.4 =	97.7 = - R -	96.8 = - R -	22.6 =	31.3 =	22.2 =	17.7 =	34.2 =	8.3 =
MAGNESIUM	MG/KG					3860 =	6440 =	2860 =	4420 =	1640 =	1350 =	1390 =	1150 J	994 J	1290 =
MANGANESE	MG/KG	2516.77	4088.00	1600.00	950.00	534 =	703 =	576 =	566 =	594 =	735 =	652 =	681 =	563 =	643 =
MERCURY	MG/KG	0.04	61.32	2.35	2.10	0.015 U	0.019 J	0.079 =	0.034 J	0.031 J	0.03 J	0.043 =	0.018 J	0.056 =	0.019 J
NICKEL	MG/KG	32.18	4088.00	156.43	100.00	7.8 J	20.5 =	9.2 =	13 =	3.9 J	4.2 J	3.3 J	4.7 J	2.9 J	3.5 J
POTASSIUM	MG/KG					1600 =	1410 =	1370 =	1020 J	1170 J	750 J	900 J	683 J	699 J	621 J
SELENIUM	MG/KG	1.85	1022.00	39.11	18.98	0.61 J	0.6 J	0.56 J	0.7 J	0.58 J	0.58 J	0.4 J	0.7 J	0.42 J	0.57 J
SILVER	MG/KG		1022.00	39.11	31.03	0.059 U	0.065 J	0.057 U	0.058 U	0.061 U	0.053 U	0.06 J	0.064 U	0.054 J	0.055 U
SODIUM	MG/KG					179 J	109 J	13.2 U	109 J	71.7 J	76 J	57.6 J	54.6 J	59.2 J	62.9 J
THALLIUM	MG/KG		14.31	0.55	3.64	0.35 J	1.2 J - R -	0.31 U	0.62 J - R -	0.35 J	0.54 J	0.4 J	0.45 J	0.62 J - R -	0.52 J
VANADIUM	MG/KG	169.89	1430.80	54.75	5111.02	36.5 J	54.7 J	35.7 J	35.3 J	29.4 J	27.6 J	24.7 J	22.3 J	23.7 J	25.5 J
ZINC	MG/KG	132.11	61320.00	2346.43	13621.80	67.7 =	68.4 =	1130 =	132 =	128 =	134 =	117 =	110 =	93 =	38.4 =
Pesticides															
p,p'-DDE	MG/KG		16.83	1.88	35.22	0.19 D	0.0027 J	0.016 =	0.013 =	0.05 =	0.055 =	0.01 =	0.0012 J	0.014 =	0.0049 =
p,p'-DDD	MG/KG		23.85	2.66	11.16	0.0039 U	0.0036 U	0.0038 U	0.0039 U	0.00077 J	0.0008 J	0.00043 J	0.0042 U	0.0034 U	0.0037 U
p,p'-DDT	MG/KG		16.83	1.88	1.16	0.125 R	0.0044 =	0.01 J	0.0094 J	0.044 =	0.026 =	0.0057 J	0.00082 J	0.0071 J	0.0049 =
Semi-Volatiles															
DIETHYL PHTHALATE	MG/KG			6300.00	450.00	0.591 U	0.535 U	0.603 U	0.561 U	0.627 U	0.467 U	0.198 J	0.085 J	0.124 J	0.495 U
BENZYL BUTYL PHTHALATE	MG/KG			1600.00	17000.00	0.591 U	0.063 J	0.603 U	0.561 U	0.627 U	0.467 U	0.514 U	0.677 U	0.53 U	0.495 U
BENZO(b)FLUORANTHENE	MG/KG		7.84	0.87	4.51	0.591 U	0.535 U	0.603 U	0.043 J	0.627 U	0.467 U	0.514 U	0.677 U	0.53 U	0.495 U
BENZO(a)PYRENE	MG/KG		0.78	0.09	0.37	0.591 U	0.535 U	0.603 U	0.04 J	0.627 U	0.467 U	0.514 U	0.677 U	0.53 U	0.495 U
Volatiles															
TOLUENE	MG/KG		40880.00	1564.29	8.79	0.018 U	0.01 U	0.0004 J	0.0007 J	0.001 J	0.011 UJ	0.0004 UJ	0.014 UJ	0.01 U	0.001 J
M,P-XYLENE (SUM OF ISOMERS)	MG/KG			16000.00	170.00	0.018 U	0.01 U	0.012 U	0.016 UJ	0.0005 J	0.011 UJ	0.011 UJ	0.014 UJ	0.01 U	0.013 U
XYLENES, TOTAL	MG/KG		408800.00	15642.86	170.19	0.018 U	0.01 U	0.012 U	0.016 UJ	0.0005 J	0.011 UJ	0.011 UJ	0.014 UJ	0.01 U	0.013 U

The risk-based concentrations are based on a hazard quotient (HQ) of 0.1 and an excess lifetime cancer risk of 10 -6.
BKG = background (2 times average) values from AFWTF Camp Garcia Western Perimeter Study (November 1999)
Industrial RBC = EPA Region III Risk Based Concentration for Soil (Industrial)
Residential RBC = EPA Region III Risk Based Concentration for Soil (Residential)
SSL = EPA Region III Soil Screening Level for Groundwater Migration (with a dilution factor (DAF) of 20

Table 7-2
Subsurface Soil Analytical Data Summary
SWMU 10, NASD - Vieques, PR

StationID				W10-SB01	W10-SB02	W10-SB03	W10-SB04	W10-SB05	W10-SB06	W10-SB07	W10-SB08	W10-SB09	W10-SB10
SampleID				NDA126	NDA129	NDA132	NDA134	NDA136	NDA138	NDA140	NDA142	NDA144	NDA146
Collection Depth				4 To 6	4 To 6	4 To 6	4 To 6	4 To 6	4 To 6	4 To 6	4 To 6	4 To 6	4 To 6
Date Collected		Screening Criteria		04/04/2000 8:25	04/04/2000 9:25	04/04/2000 9:50	04/04/2000 13:08	04/04/2000 13:33	04/04/2000 13:55	04/04/2000 14:17	04/04/2000 14:35	04/04/2000 14:55	04/04/2000 15:10
Parameter Name	Units	BKG	SSL (L)										
Metals													
ALUMINUM	MG/KG			5860 =	6420 =	8560 =	4640 =	7050 =	6540 =	5720 =	5030 =	5490 =	5000 =
ANTIMONY	MG/KG	1.76	13.20	0.31 J	0.16 UJ	0.18 UJ	0.17 UJ	0.17 UJ	0.21 J	0.15 UJ	0.27 J	0.2 J	0.15 UJ
ARSENIC	MG/KG	2.08	0.03	0.37 U	0.38 U	0.43 U	0.42 U	0.4 U	**0.44 J -**	0.37 U	**0.91 J -**	0.37 U	**0.57 J -**
BARIUM	MG/KG	167.17	2105.32	91.5 =	101 =	139 =	72.1 =	101 =	107 =	74.3 =	72.9 =	105 =	80.6 =
BERYLLIUM	MG/KG	0.58	1153.69	0.18 J	0.21 J	0.3 J	0.18 J	0.26 J	0.21 J	0.18 J	0.18 J	0.19 J	0.18 J
CALCIUM	MG/KG			3100 =	1990 =	2340 =	1780 =	2020 =	2020 =	1060 =	1250 =	1500 =	1640 =
CHROMIUM, TOTAL	MG/KG	45.92	40.00	8.2 =	5.6 =	6.9 =	7 =	6.6 =	7.4 =	4.9 =	6 =	7.5 =	5.6 =
COBALT	MG/KG	39.41		7.5 J	8.2 J	10.9 =	5.3 J	8.8 J	9.6 J	9.5 J	6.5 J	9.5 J	7.3 J
COPPER	MG/KG	147.78	10517.84	26.1 =	25.2 =	32.6 =	19.6 =	26.3 =	32.2 =	20.3 =	27.8 =	31.1 =	19.1 =
IRON	MG/KG	9360.00		12200 =	13200 =	17700 =	10300 =	15200 =	14400 =	11000 =	10800 =	12100 =	10300 =
LEAD	MG/KG	4.19		3.3 =	1.2 =	2.4 =	0.94 =	1.3 =	2.6 =	1.5 =	5.1 =	16.2 =	4.3 =
MAGNESIUM	MG/KG			2950 =	2900 =	3940 =	2330 =	3440 =	4020 =	2410 =	2170 =	2350 =	2190 =
MANGANESE	MG/KG	2516.77	950.00	407 =	447 =	597 =	298 =	510 =	515 =	590 =	395 =	551 =	516 =
MERCURY	MG/KG	0.04	2.10	0.0097 U	0.016 U	0.0099 U	0.017 U	0.013 U	0.014 U	0.011 U	0.013 U	0.024 J	0.011 U
NICKEL	MG/KG	32.18	100.00	4.4 J	3.3 J	4.5 J	3.2 J	3.9 J	3.9 J	2.7 J	2.8 J	3.6 J	3.5 J
POTASSIUM	MG/KG			1110 =	1160 =	1190 =	710 J	1040 =	803 J	861 J	772 J	818 J	809 J
SELENIUM	MG/KG	1.85	18.98	0.53 J	0.53 J	0.53 J	0.53 J	0.6 J	0.5 J	0.43 J	0.48 J	0.58 J	0.23 U
SODIUM	MG/KG			96.4 J	59.5 J	49.2 J	55.8 J	89.8 J	75.5 J	135 J	96.5 J	67.3 J	157 J
THALLIUM	MG/KG		3.64	0.5 J	0.59 J	0.95 J	0.93 J	1.3 J	0.84 J	0.54 J	0.75 J	0.71 J	0.59 J
VANADIUM	MG/KG	169.89	5111.02	36.2 J	38.1 J	56.9 J	30.8 J	45.6 J	37.3 J	35 J	32.9 J	37 J	29.3 J
ZINC	MG/KG	132.11	13621.80	31.7 =	26.6 =	33.9 =	20.4 =	29.8 =	38.5 =	22.1 =	41.2 =	56.6 =	31.8 =
Pesticides													
p,p'-DDE	MG/KG		35.22	0.021 =	0.0037 U	0.0041 U	0.0041 U	0.0039 U	0.0012 J	0.0037 U	0.0008 J	0.015 =	0.0013 J
p,p'-DDD	MG/KG		11.16	0.0036 U	0.0037 U	0.0041 U	0.0041 U	0.0039 U	0.0036 U	0.0037 U	0.0039 U	0.00067 J	0.0036 U
p,p'-DDT	MG/KG		1.16	0.011 =	0.0037 U	0.0041 U	0.0041 U	0.0039 U	0.001 J	0.0037 U	0.0039 U	0.0076 J	0.001 J
Semi-Volatiles													
DIETHYL PHTHALATE	MG/KG		450.00	0.453 U	0.484 U	0.562 U	0.515 U	0.475 U	0.214 J	0.057 J	0.145 J	0.051 J	0.162 J
Volatiles													
1,2-DICHLOROETHANE	MG/KG		0.001	0.013 U	0.012 U	0.0003 J	0.01 U	0.011 U	0.0003 J	0.01 U	0.01 U	0.0003 J	0.011 U

The risk-based concentrations are based on a hazard quotient (HQ) of 0.1 and an excess lifetime cancer risk of 10 -6.
BKG = background (2 times average) values from AFWTF Camp Garcia Western Perimeter Study (November 1999)
SSL = EPA Region III Soil Screening Level for Groundwater Migration (with a dilution factor (DAF) of 20



0' 25' 50' 75' 100' 125'

LEGEND

- BUILDING
- BITUMINOUS PAVEMENT
- OVERHEAD POWER — OH —
- PALM TREE
- TREE
- LIGHT POLE
- POWER POLE
- GUY WIRE
- SOIL BORING ■ SB-01

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Figure 7-1 SWMU-10
Sample Locations
Naval Ammunition Support Detachment, Vieques Island

CH2MHILL

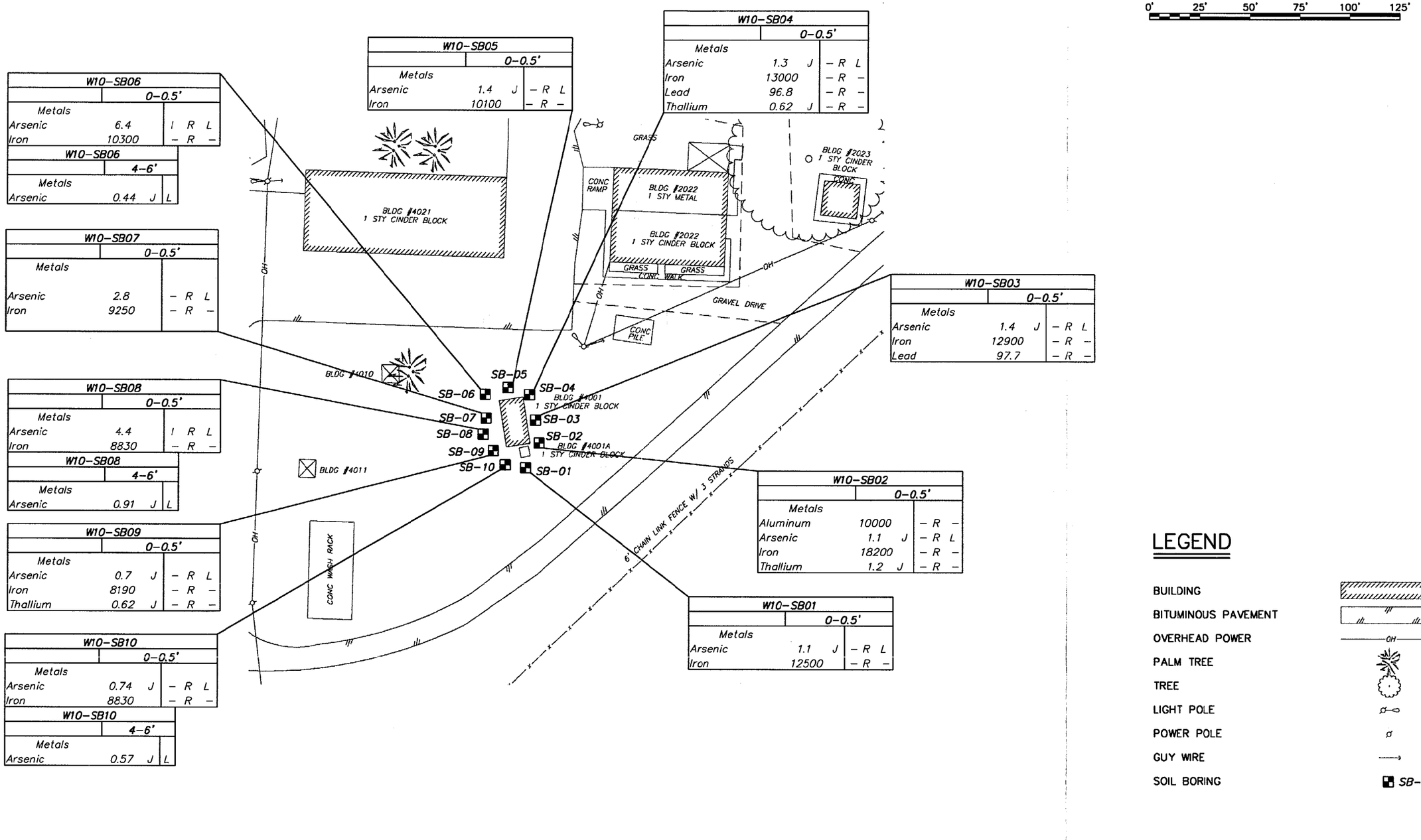

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Figure 7-2 SWMU-10
Soil Detections Above Screening Criteria
Naval Ammunition Support Detachment, Vieques Island

CH2MHILL

SECTION 8

SWMU 14 Wash Rack

This section presents the results of the Expanded PA/SI investigation performed at SWMU 14 – Wash Rack at NASD, Vieques, Puerto Rico. The field sampling activities associated with this investigation were performed by CH2M HILL in April and May, 2000.

This section includes a description of the objectives of the Expanded PA/SI, a site description, results of previous investigations, summary of field activities, summary of laboratory results, and conclusions and recommendations. To evaluate the potential for environmental impacts from the site, data were compared to applicable regulatory screening and background values. A description of the environmental screening process was presented in Section 2.14 of this report.

8.1 Objectives

The specific objectives of this investigation were to:

1. determine if a release of hazardous materials has occurred as a result of site-related activities; and
2. Assess whether the site is a candidate for closeout as a NFRAP site, or
3. Determine if further investigation or evaluation are warranted at this SWMU.

8.2 Site Description

This unit is located near the Transportation Shop (Building 2016) and has been in use since the late 1970s. The area is a concrete driveway with 4-inch curbs on each side and ramps on each end, measuring approximately 20 feet long by 10 feet wide. The area is used primarily for cleaning Navy vehicles. Facility personnel stated that degreasing solvents were occasionally used in this area to facilitate cleaning. A swale at the end of the unit facilitates the discharge of runoff water to a ditch which eventually discharges to the Atlantic Ocean.

8.2.1 Summary of Qualitative Ecological Survey

The site consists mainly of concrete-covered surfaces with small grassed areas that are frequently mowed by Public Work staff. The herbaceous species include *Bothriochloa ishaemum, Digitaria ciliaris, Cynodon dactylon,* and *Commelina erecta.*

Wildlife observed at this site is typical for developed grassed areas on Vieques. This site is very small and offers very limited habitat for any wildlife species. Occasional common passerine birds may frequent this area but to a very limited extent.

8.3 Previous Investigation Results

No previous sampling has been conducted at this site.

8.4 Field Investigations

The PA/SI of SWMU 14 included the installation and sampling of two monitoring wells, collection of 14 surface soil samples and 14 subsurface soil samples, and collection of three samples of the accumulated soil from the oil/water separator. Figure 8-1 shows the sampling locations. All samples were analyzed for metals, VOCs, SVOCs, pesticides, and PCBs.

8.4.1 Groundwater Sampling

Monitoring well SWMU14-MW01 was installed upgradient of the washrack as an upgradient monitoring well. SWMU14-MW02 was installed downgradient of the washrack to evaluate whether a release hazardous materials to groundwater has occurred as a result of washrack operations.

Prior to sampling, the depths to groundwater were measured using an electronic water level indicator to verify groundwater flow directions. These data were used in conjunction with the survey data to determine elevations of groundwater at each monitoring well. As shown in Figure 8-2, the groundwater flow direction is to the north.

8.4.2 Soil Sampling

Fourteen surface soil samples (0 to 6 inches bls) and 14 subsurface soil samples (5 feet bls) were collected around the perimeter of the washrack to evaluate whether a release of

hazardous materials or petroleum products to groundwater has occurred as a result of washrack operations.

8.4.3 Sediment Sampling

Three sediment samples were collected from within the washrack oil/water separator to evaluate whether hazardous materials or petroleum products have accumulated in the oil/water separator as a result of washrack operations.

8.5 Field Screening Results

Soil samples were screened in the field for VOCs using an OVM. This field screening method provides a qualitative evaluation of potential organic constituents in soil. The OVM results for the site are summarized in Appendix B. The results indicate that the OVM readings ranged from 0.0 ppm to 60.7 ppm for soil samples collected at SWMU 14. Only three samples had readings above 10 ppm. The majority of samples were 0.0 ppm, indicating that no release of organic constituents had occurred at this site.

8.6 Laboratory Analytical Results and Risk Based Screening Analysis

The following section presents the interpretation of the analytical data from the SWMU 14 Expanded PA/SI investigation. The discussion includes the identification of screening/regulatory criteria exceedances as well as to background criteria. Conclusions and recommendations, by media, are presented in Section 8.6.

Concentrations of detected chemicals were compared to the following current USEPA screening criteria for each matrix: residential and industrial RBCs and soil screening level criteria for soil; and tap water RBCs and drinking water MCLs for groundwater. Preliminary background criteria were obtained from data collected from Camp Garcia.

Appendix I contains a compilation of the concentrations for all chemicals for which samples were analyzed. Appendix J contains a data validation summary.

8.6.1 Groundwater Results

Analytical results from unfiltered (total metals) samples indicate detections of aluminum, antimony, iron, manganese and vanadium in groundwater samples at concentrations

exceeding the MCLs and/or RBCs. Filtered metals (dissolved) results show detections of antimony and manganese above groundwater criteria. While the concentrations of total metals were slightly higher in SWMU14-MWS02 than concentrations detected in upgradient monitoring well SWMU14-MWS01, the dissolved metals were detected at relatively similar concentrations, indicating that the detections are likely indicative of background conditions and are not site-related.

Dieldrin was detected in upgradient monitoring well MW01 at a concentration slightly greater than the RBC.

VOCs, SVOCs, and PCBs were either not detected or were detected at concentrations below their applicable screening criteria. Table 8-1 summarizes the groundwater detections, which are presented graphically on Figure 8-3.

8.6.2 Surface Soil Results

Analytical results indicate detections of aluminum, arsenic, iron, lead, thallium, and vanadium in surface soil at concentrations above the residential RBCs and/or leachability screening criteria. These metals were detected in all soil samples at relatively similar concentrations, indicating that the detections are likely indicative of background conditions and are not site-related.

VOCs, SVOCs, pesticides, and PCBs were either not detected or were detected at concentrations below their applicable screening criteria. Table 8-2 summarizes the surface soil detections, which are presented graphically on Figure 8-4.

8.6.3 Subsurface Soil Results

Arsenic was detected in four samples at concentrations above the leachability criterion, but below the background criteria. No other metals were detected above leachability or background criteria.

VOCs, SVOCs, pesticides, and PCBs were either not detected or were detected at concentrations below their applicable screening criteria. Table 8-3 summarizes the subsurface soil detections.

8.6.4 Sediment

Sediment samples were collected from within the sumps of the washrack and are not considered media samples. Therefore, these samples were not screened against soil or sediment criteria. SVOCs and chlorinated pesticides were detected in these samples.

8.7 Conclusions and Recommendations

This section summarizes the results of the Expanded PA/SI activities by media, and provides recommendations for each media sampled.

8.7.1 Groundwater

Analytical results indicate detections of dissolved metals at relatively similar concentrations in both the upgradient and downgradient monitoring wells at the site, indicating that the detections are likely indicative of background conditions and are not site-related.

Dieldrin was detected in upgradient monitoring well SWMU 14 - MW01 at a concentration slightly greater than the RBC and therefore is not likely site-related.

VOCs, SVOCs, and PCBs were either not detected or were detected at concentrations below their applicable screening criteria.

Based on the groundwater analytical results, no additional groundwater investigations are recommended. However, it is recommended that a Preliminary Risk Evaluation (PRE) be conducted to calculate the potential risk to human health presented by metals in groundwater at the site.

8.7.2 Surface Soil

Metals were detected in surface soil samples at concentrations indicative of site background levels. All other parameters were either not detected, or were detected below the applicable screening criteria. No evidence exists to suggest that a release of hazardous materials to surface soil has occurred at this site as a result of site-related activities. However, a background soil investigation is recommended to verify that the metals detected are within the background range for NASD. Additionally, it is recommended that a Preliminary Risk Evaluation (PRE) be conducted to calculate the potential risk to human health presented by metals in surface soil at the site.

8.7.3 Subsurface Soil Samples

Arsenic was detected in subsurface soil at concentrations indicative of site background levels. All other parameters were either not detected or were detected below the applicable screening criteria. No evidence exists to suggest that a release of hazardous materials to subsurface soil has occurred at this site as a result of site-related activities. However, a background-soil investigation is recommended to verify that the metals detected are within the background range for NASD. Additionally, it is recommended that a Preliminary Risk Evaluation (PRE) be conducted to calculate the potential risk to human health presented by metals in subsurface soil at the site.

8.7.4 Institutional Controls

A chain-link fence and signs will be installed around SWMU-14 and the wash rack will be removed. The fence and signs will remain until the CERCLA process is completed for SWMU-14.

Table 8-1
Groundwater Analytical Data Summary
SWMU 14, NASD - Vieques, PR

StationID			Screening Criteria		SWMU14-MW01	SWMU14-MW02
SampleID					NDA014	NDA013
Date Collected					04/28/2000 11:00	04/28/2000 12:00
Paramater Name	Units	BKG	Federal MCL (M)	Tapwater RBC (T)		
Dissolved Metals						
ALUMINUM, DISSOLVED	MG/L		0.05	3.65	0.0258 U	0.028 J
ANTIMONY, DISSOLVED	MG/L		0.01	0.0015	0.0014 U	0.0021 J - T
BARIUM, DISSOLVED	MG/L	0.28	2.00	0.26	0.0888 J	0.0902 J
CALCIUM, DISSOLVED	MG/L				51.6 =	58.7 =
CHROMIUM, DISSOLVED	MG/L	0.02	0.10	0.11	0.0016 J	0.0018 J
COBALT, DISSOLVED	MG/L	0.02		0.22	0.0005 U	0.00094 J
COPPER, DISSOLVED	MG/L	0.04	1.00	0.15	0.0035 J	0.0019 U
IRON, DISSOLVED	MG/L		0.30	1.10	0.0122 =	0.0122 =
LEAD, DISSOLVED	MG/L		0.01		0.0012 J	0.0011 U
MAGNESIUM, DISSOLVED	MG/L				25.7 =	23.2 =
MANGANESE, DISSOLVED	MG/L		0.05	0.07	0.084 = M T	1.16 = M T
NICKEL, DISSOLVED	MG/L	0.02	0.10	0.07	0.0008 U	0.0124 J
POTASSIUM, DISSOLVED	MG/L				3.06 J	3.25 J
SODIUM, DISSOLVED	MG/L				118 J	96.1 J
VANADIUM, DISSOLVED	MG/L	0.04		0.03	0.0202 J	0.0153 J
ZINC, DISSOLVED	MG/L	0.14	5.00	1.10	0.0034 J	0.003 J
Total Metals						
ALUMINUM	MG/L		0.05	3.65	0.152 J M -	26.1 = M T
ANTIMONY	MG/L		0.01	0.0015	0.0014 U	0.0023 J - T
BARIUM	MG/L	0.28	2.00	0.26	0.0916 J	0.25 =
CALCIUM	MG/L				49.6 =	86.3 =
CHROMIUM, TOTAL	MG/L	0.02	0.10	0.11	0.0033 J	0.068 =
COBALT	MG/L	0.02		0.22	0.0005 U	0.022 J
COPPER	MG/L	0.04	1.00	0.15	0.0019 U	0.0701 =
IRON	MG/L		0.30	1.10	0.147 J	32.1 J M T
LEAD	MG/L		0.01		0.0011 U	0.0051 =
MAGNESIUM	MG/L				24.8 =	35.7 =
MANGANESE	MG/L		0.05	0.07	0.097 = M T	1.82 = M T
NICKEL	MG/L	0.02	0.10	0.07	0.0015 J	0.04 J
POTASSIUM	MG/L				3.12 J	5.68 J
SELENIUM	MG/L	0.02	0.05	0.02	0.0021 U	0.0052 =
SODIUM	MG/L				116 J	108 J
VANADIUM	MG/L	0.04		0.03	0.0202 J	0.108 = - T
ZINC	MG/L	0.14	5.00	1.10	0.0038 J	0.092 =
Pesticides						
DIELDRIN	MG/L			0.000004	0.00001 J - T	0.00002 U

Table 8-2
Surface Soil Analytical Data Summary
SWMU-14, NASD - Vieques, PR

	StationID	Screening Criteria				W14-SB01	W14-SB02	W14-SB03	W14-SB04	W14-SB05	W14-SB06	W14-SB07	W14-SB08
	SampleID					NDA147	NDA149	NDA153	NDA155	NDA157	NDA159	NDA161	NDA164
	Collection Depth		Industrial	Residential		0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5
	Date Collected		RBC-I	RBC	SSL	04/05/2000 10:30	04/05/2000 11:05	04/05/2000 11:40	04/05/2000 13:00	04/05/2000 13:10	04/05/2000 14:25	04/05/2000 14:45	04/06/2000 9:38
Parameter	Units	2*BKG	(I)	(R)	(L)								
Metals													
ALUMINUM	MG/KG		204400.00	7821.43		7140 =	6900 =	6460 =	4900 =	6320 =	4910 =	5960 =	13400 = - R -
ANTIMONY	MG/KG	1.76	81.76	3.13	13.20	0.2 J	0.36 J	0.17 J	0.2 J	0.21 J	0.33 J	0.61 J	0.18 J
ARSENIC	MG/KG	2.08	3.82	0.43	0.03	0.65 J - R L	1.5 J - R L	0.48 J - R L	0.39 U	0.52 J - R L	0.5 J - R L	1.2 J - R L	1.5 J - R L
BARIUM	MG/KG	167.17	14308.00	547.50	2105.32	43.8 =	53.5 =	59.3 =	55.8 =	27.4 J	84.2 =	53.5 =	73.8 =
BERYLLIUM	MG/KG	0.58	408.80	15.64	1153.69	0.11 J	0.13 J	0.16 J	0.15 J	0.072 J	0.12 J	0.098 J	0.25 J
CADMIUM	MG/KG	0.35	102.20	3.91	27.45	0.41 J	0.6 J	0.073 J	0.023 U	0.02 U	0.12 J	2 =	1.2 J
CALCIUM	MG/KG					13400 =	19800 =	11100 =	1710 =	10100 =	2970 =	27600 =	3150 =
CHROMIUM, TOTAL	MG/KG	45.92	450.00	210.00	40.00	10 J	16.1 J	9.7 J	5.3 J	18 J	5.8 J	17.1 J	20.7 =
COBALT	MG/KG	39.41	12264.00	469.29		7 J	7.9 J	7 J	7.6 J	6.1 J	8.6 J	7.7 J	12.5 =
COPPER	MG/KG	147.78	8176.00	312.86	10517.84	36.4 =	47.2 =	34.8 =	14.3 =	25.7 =	20.1 =	77.8 =	44.5 =
IRON	MG/KG	9360.00	61320.00	2346.43		13800 = - R -	15500 = - R -	14900 = - R -	7490 = - R -	10300 = - R -	9130 = - R -	12600 = - R -	24500 = - R -
LEAD	MG/KG	4.19	100.00	40.00		15.3 =	12.7 =	10 =	2.5 =	20.5 =	11.2 =	43.6 = - R -	44.1 = - R -
MAGNESIUM	MG/KG					4870 =	5080 =	3320 =	1380 =	4660 =	1760 =	4660 =	3520 =
MANGANESE	MG/KG	2516.77	4088.00	1600.00	950.00	449 J	374 J	375 J	607 J	263 J	792 J	369 J	710 J
MERCURY	MG/KG	0.04	61.32	2.35	2.10	0.11 =	0.011 U	0.025 J	0.012 U	0.013 U	0.03 J	0.14 =	0.054 =
NICKEL	MG/KG	32.18	4088.00	156.43	100.00	7 J	7.6 J	5.5 J	3.9 J	8.3 =	3.8 J	7.5 J	8 J
POTASSIUM	MG/KG					778 J	1000 J	1160 =	740 J	460 J	1130 =	747 J	1590 =
SELENIUM	MG/KG	1.85	1022.00	39.11	18.98	0.58 J	0.43 J	0.4 J	0.36 J	0.3 J	0.64 J	0.39 J	0.57 J
SILVER	MG/KG		1022.00	39.11	31.03	0.052 U	0.054 U	0.054 U	0.057 U	0.056 J	0.052 U	0.052 U	0.062 U
SODIUM	MG/KG					186 J	204 J	149 J	128 J	241 J	50.6 J	267 J	102 J
THALLIUM	MG/KG		14.31	0.55	3.64	1.2 J - R -	0.77 J - R -	0.57 J - R -	0.52 J	0.27 U	0.7 J - R -	0.4 J	1.7 J - R -
VANADIUM	MG/KG	169.89	1430.80	54.75	5111.02	32.1 =	39.1 =	36 =	19.7 =	26.4 =	25.4 =	33.5 =	68 = - R -
ZINC	MG/KG	132.11	61320.00	2346.43	13621.80	68.6 =	94 J	55.7 =	16.5 =	44.7 =	33.5 =	139 =	136 J
Pesticides													
DIELDRIN	MG/KG		0.36	0.04	0.00	0.0035 U	0.0036 U	0.0035 U	0.0038 U	0.0034 U	0.0034 U	0.0035 U	0.0041 UJ
p,p'-DDE	MG/KG		16.83	1.88	35.22	0.0005 J	0.00077 J	0.0035 U	0.0038 U	0.003 J	0.0034 U	0.00069 J	0.0041 UJ
p,p'-DDD	MG/KG		23.85	2.66	11.16	0.0035 U	0.0036 U	0.0035 U	0.0038 U	0.00068 J	0.0034 U	0.0035 U	0.0041 UJ
METHOXYCHLOR	MG/KG		1022.00	39.11	305.05	0.018 UJ	0.0012 J	0.018 UJ	0.019 UJ	0.017 UJ	0.018 UJ	0.018 UJ	0.021 UJ
Semi-Volatiles													
DIMETHYL PHTHALATE	MG/KG			78000.00		0.471 U	5.8 J	4.99 U	0.591 U	0.552 U	0.409 U	0.524 U	0.621 U
DI-n-BUTYL PHTHALATE	MG/KG			780.00	5000.00	0.471 U	0.04 J	4.99 U	0.591 U	0.552 U	0.409 U	0.524 U	0.621 U
BENZYL BUTYL PHTHALATE	MG/KG			1600.00	17000.00	0.471 U	0.556 U	4.99 U	0.591 U	0.552 U	0.409 U	0.076 J	0.621 U
bis(2-ETHYLHEXYL) PHTHALATE	MG/KG			46.00	2900.00	0.471 U	0.058 J	4.99 U	0.591 U	0.042 J	0.409 U	0.116 J	0.621 U
Volatiles													
CARBON DISULFIDE	MG/KG			780.00	19.00	0.011 U	0.011 U	0.012 U	0.011 U	0.011 U	0.014 UJ	0.011 U	0.013 U
METHYL ETHYL KETONE (2-BUTANONE)	MG/KG			4700.00	7.90	0.011 R	0.011 R	0.012 R	0.011 R	0.011 R	0.014 R	0.011 R	0.013 R
BENZENE	MG/KG		197.35	22.03	0.00	0.011 U	0.011 U	0.012 U	0.011 U	0.011 U	0.014 UJ	0.011 U	0.0002 J
1,2-DICHLOROETHANE	MG/KG			7.00	0.00	0.011 U	0.011 U	0.012 U	0.011 U	0.011 U	0.014 UJ	0.011 U	0.0004 J
TOLUENE	MG/KG		40880.00	1564.29	8.79	0.001 J	0.011 U	0.0004 J	0.0003 U	0.011 U	0.014 UJ	0.011 U	0.001 J
ETHYLBENZENE	MG/KG		20000.00	780.00	15.00	0.011 U	0.011 U	0.012 U	0.011 U	0.011 U	0.014 UJ	0.011 U	0.001 J
M,P-XYLENE (SUM OF ISOMERS)	MG/KG			16000.00	170.00	0.001 J	0.0003 J	0.0004 J	0.0003 J	0.011 U	0.0003 J	0.0002 U	0.005 J
O-XYLENE (1,2-DIMETHYLBENZENE)	MG/KG		408800.00	15642.86	229.95	0.0004 J	0.011 U	0.012 U	0.0003 J	0.011 U	0.014 UJ	0.011 U	0.002 J
XYLENES, TOTAL	MG/KG		408800.00	15642.86	170.19	0.002 J	0.0003 J	0.0004 J	0.0005 J	0.011 U	0.0003 J	0.0002 U	0.007 J

The risk-based concentrations are based on a hazard quotient (HQ) of 0.1 and an excess lifetime cancer risk of 10 -6.
BKG = background (2 times average) values from AFWTF Camp Garcia Western Perimeter Study (November 1999)
Industrial RBC = EPA Region III Risk Based Concentration for Soil (Industrial)
Residential RBC = EPA Region III Risk Based Concentration for Soil (Residential)
SSL = EPA Region III Soil Screening Level for Groundwater Migration (with a dilution factor (DAF) of 20

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Table 8-2
Surface Soil Analytical Data Summary
SWMU-14, NASD - Vieques, PR

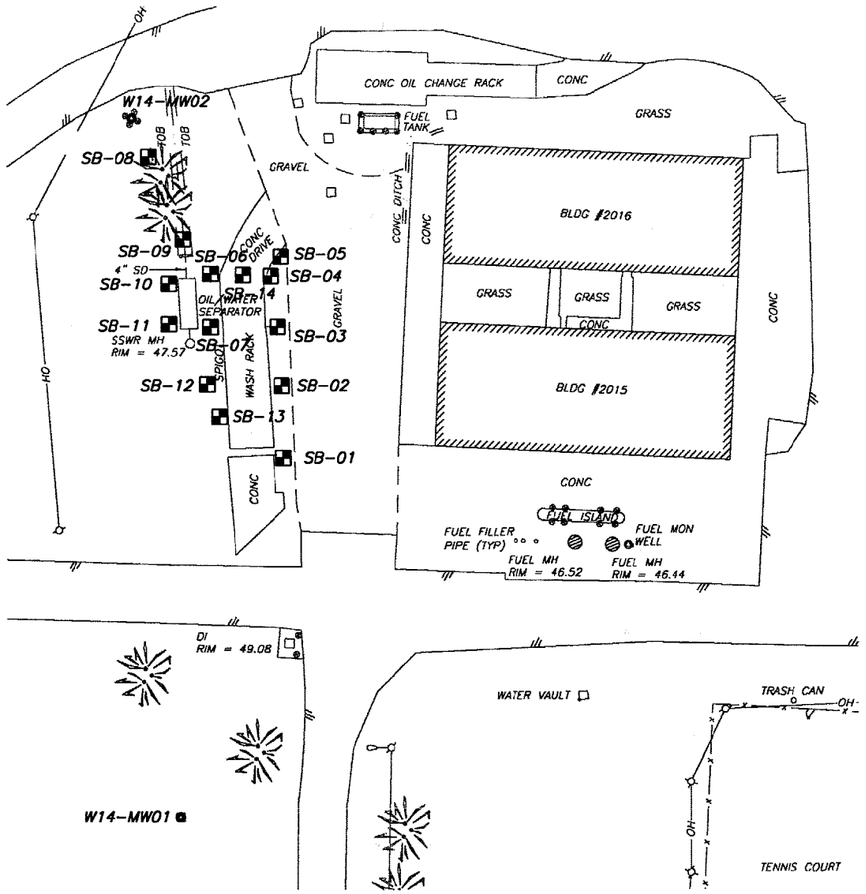
	StationID		Screening Criteria			W14-SB09	W14-SB10	W14-SB11	W14-SB12	W14-SB13	W14-SB14
	SampleID					NDA166	NDA168	NDA170	NDA172	NDA174	NDA176
	Collection Depth					0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5
	Date Collected					04/06/2000 9:50	04/06/2000 10:25	04/06/2000 10:55	04/06/2000 11:20	04/06/2000 12:55	04/06/2000 13:45
Parameter	Units	2*BKG	Industrial RBC-I (I)	Residential RBC (R)	SSL (L)						
Metals											
ALUMINUM	MG/KG		204400.00	7821.43		10400 = - R -	13600 = - R -	11000 = - R -	5970 =	5330 =	16300 = - R -
ANTIMONY	MG/KG	1.76	81.76	3.13	13.20	0.17 UJ	0.74 J	0.58 J	0.38 J	0.15 UJ	0.57 J
ARSENIC	MG/KG	2.08	3.82	0.43	0.03	0.58 J - R L	1.7 J - R L	1.3 J - R L	0.76 J - R L	0.4 J - - L	3 = - R L
BARIUM	MG/KG	167.17	14308.00	547.50	2105.32	63.6 =	97.1 =	78 =	51.3 =	67.7 =	159 =
BERYLLIUM	MG/KG	0.58	408.80	15.64	1153.69	0.21 J	0.19 J	0.19 J	0.13 J	0.12 J	0.27 J
CADMIUM	MG/KG	0.35	102.20	3.91	27.45	0.025 U	3.2 =	1.8 =	0.54 J	0.021 U	0.34 J
CALCIUM	MG/KG					16600 =	25100 =	18300 =	5900 =	2720 =	71200 =
CHROMIUM, TOTAL	MG/KG	45.92	450.00	210.00	40.00	10 =	31.5 =	29.5 =	12.2 =	7.6 =	20 =
COBALT	MG/KG	39.41	12264.00	469.29		8.2 J	11.8 =	11.4 J	6.8 J	7.7 J	10 J
COPPER	MG/KG	147.78	8176.00	312.86	10517.84	25.3 =	96.6 =	72.5 =	38.7 =	20.7 =	66.1 =
IRON	MG/KG	9360.00	61320.00	2346.43		18300 = - R -	24600 = - R -	21600 = - R -	14200 = - R -	12300 = - R -	28300 = - R -
LEAD	MG/KG	4.19	100.00	40.00		8.1 =	55.9 = - R -	70.7 = - R -	39.6 =	10 =	12.7 =
MAGNESIUM	MG/KG					3280 =	6910 =	5600 =	2340 =	1320 =	4250 =
MANGANESE	MG/KG	2516.77	4088.00	1600.00	950.00	435 J	506 J	587 J	544 J	907 J	419 J
MERCURY	MG/KG	0.04	61.32	2.35	2.10	0.04 =	0.074 =	0.086 =	0.015 U	0.03 J	0.018 U
NICKEL	MG/KG	32.18	4088.00	156.43	100.00	3.9 J	16.4 =	10 =	4.9 J	4.1 J	9 J
POTASSIUM	MG/KG					1140 J	1160 J	1480 =	885 J	782 J	2740 =
SELENIUM	MG/KG	1.85	1022.00	39.11	18.98	0.4 J	0.45 J	0.47 J	0.23 U	0.56 J	0.29 U
SILVER	MG/KG		1022.00	39.11	31.03	0.062 U	0.059 U	0.06 U	0.054 U	0.053 U	0.096 J
SODIUM	MG/KG					171 J	475 J	243 J	101 J	95.6 J	337 J
THALLIUM	MG/KG		14.31	0.55	3.64	0.45 J	0.32 U	0.43 J	0.4 J	0.58 J - R -	0.38 U
VANADIUM	MG/KG	169.89	1430.80	54.75	5111.02	53.3 =	69.1 = - R -	61.3 = - R -	36.9 =	37.2 =	74.3 = - R -
ZINC	MG/KG	132.11	61320.00	2346.43	13621.80	48.2 J	229 J	172 J	73.8 J	48.5 J	94.3 J
Pesticides											
DIELDRIN	MG/KG		0.36	0.04	0.00	0.0041 UJ	0.00045 J	0.004 UJ	0.0036 UJ	0.0035 UJ	0.0093 UJ
p,p'-DDE	MG/KG		16.83	1.88	35.22	0.0041 UJ	0.0039 UJ	0.00077 J	0.0036 UJ	0.001 J	0.0093 UJ
p,p'-DDD	MG/KG		23.85	2.66	11.16	0.0041 UJ	0.0039 UJ	0.004 UJ	0.0036 UJ	0.0035 UJ	0.0093 UJ
METHOXYCHLOR	MG/KG		1022.00	39.11	305.05	0.021 UJ	0.02 UJ	0.02 UJ	0.018 UJ	0.018 UJ	0.048 UJ
Semi-Volatiles											
DIMETHYL PHTHALATE	MG/KG			78000.00		0.604 U	0.579 U	0.636 U	0.475 U	0.535 U	0.699 U
DI-n-BUTYL PHTHALATE	MG/KG			780.00	5000.00	0.604 U	0.579 U	0.636 U	0.475 U	0.535 U	0.699 U
BENZYL BUTYL PHTHALATE	MG/KG			1600.00	17000.00	0.604 U	0.329 J	0.636 U	0.475 U	0.535 U	0.699 U
bis(2-ETHYLHEXYL) PHTHALATE	MG/KG			46.00	2900.00	0.604 U	0.158 J	0.078 J	0.073 J	0.066 J	0.699 U
Volatiles											
CARBON DISULFIDE	MG/KG			780.00	19.00	0.011 U	0.02 U	0.016 UJ	0.01 U	0.01 U	0.0009 J
METHYL ETHYL KETONE (2-BUTANONE)	MG/KG			4700.00	7.90	0.011 R	0.02 R	0.016 R	0.01 R	0.01 R	0.018 J
BENZENE	MG/KG		197.35	22.03	0.00	0.011 U	0.02 U	0.016 UJ	0.0001 U	0.0001 U	0.0002 U
1,2-DICHLOROETHANE	MG/KG			7.00	0.00	0.0003 J	0.02 U	0.016 UJ	0.01 U	0.01 U	0.014 U
TOLUENE	MG/KG		40880.00	1564.29	8.79	0.0003 U	0.02 U	0.016 UJ	0.0004 J	0.0003 J	0.0005 J
ETHYLBENZENE	MG/KG		20000.00	780.00	15.00	0.011 U	0.02 U	0.016 UJ	0.01 U	0.01 U	0.014 U
M,P-XYLENE (SUM OF ISOMERS)	MG/KG			16000.00	170.00	0.0003 J	0.02 U	0.0004 J	0.0002 U	0.0002 U	0.014 U
O-XYLENE (1,2-DIMETHYLBENZENE)	MG/KG		408800.00	15642.86	229.95	0.011 U	0.02 U	0.016 UJ	0.01 U	0.01 U	0.014 U
XYLENES, TOTAL	MG/KG		408800.00	15642.86	170.19	0.0003 J	0.02 U	0.0004 J	0.0002 U	0.0002 U	0.014 U

The risk-based concentrations are based on a hazard quotient (HQ) of 0.1 and an exce
BKG = background (2 times average) values from AFWTF Camp Garcia Western Perime
Industrial RBC = EPA Region III Risk Based Concentration for Soil (Industrial)
Residential RBC = EPA Region III Risk Based Concentration for Soil (Residential)
SSL = EPA Region III Soil Screening Level for Groundwater Migration (with a dilution facto

Table 8-3
Subsurface Soil Analytical Data Summary
SWMU 14, NASD - Vieques, PR

Parameter Name	Units	Screening Criteria BKG	Screening Criteria SSL (L)	W14-SB01 NDA148 4 To 6 04/05/2000 10:45	W14-SB02 NDA151 4 To 6 04/05/2000 11:20	W14-SB03 NDA154 4 To 6 04/05/2000 13:20	W14-SB04 NDA156 4 To 6 04/05/2000 13:38	W14-SB05 NDA158 4 To 6 04/05/2000 14:15	W14-SB06 NDA160 4 To 6 04/05/2000 14:35	W14-SB07 NDA162 4 To 6 04/05/2000 14:50	W14-SB08 NDA165 4 To 6 04/06/2000 9:50	W14-SB09 NDA167 4 To 6 04/06/2000 10:20	W14-SB10 NDA169 4 To 6 04/06/2000 10:35	W14-SB11 NDA171 4 To 6 04/06/2000 11:00	W14-SB12 NDA173 4 To 6 04/06/2000 11:30	W14-SB13 NDA175 4 To 6 04/06/2000 13:25	W14-SB14 NDA177 4 To 6 04/06/2000 13:55
Metals																	
ALUMINUM	MG/KG			8790 =	8220 =	7070 =	10100 =	5740 =	8400 =	6790 =	11600 =	8380 =	8810 =	7110 =	9470 =	12400 =	13400 =
ANTIMONY	MG/KG	1.76	13.20	0.17 UJ	0.16 UJ	0.16 UJ	0.26 J	0.15 UJ	0.24 J	0.16 UJ	0.16 UJ	0.15 UJ	0.15 UJ	0.15 UJ	0.18 UJ	0.16 UJ	0.16 UJ
ARSENIC	MG/KG	2.08	0.03	0.56 J -	0.39 U	0.38 U	0.37 U	0.37 U	0.49 J -	0.39 U	0.39 U	0.37 U	0.37 U	0.37 U	0.44 U	0.39 J -	0.66 J -
BARIUM	MG/KG	167.17	2105.32	130 =	96.7 =	80.9 =	131 =	115 =	156 =	57 =	113 =	79.9 =	61.8 =	48.2 =	81.6 =	70.2 =	90.8 =
BERYLLIUM	MG/KG	0.58	1153.69	0.28 J	0.23 J	0.19 J	0.31 J	0.13 J	0.31 J	0.21 J	0.27 J	0.21 J	0.23 J	0.18 J	0.27 J	0.27 J	0.29 J
CALCIUM	MG/KG			3160 =	2840 =	4660 =	2940 =	4390 =	2570 =	2030 =	2830 =	2410 =	3770 =	2830 =	2530 =	3040 =	6280 =
CHROMIUM, TOTAL	MG/KG	45.92	40.00	14.4 J	10 J	9.2 J	13.3 J	9.1 J	11.4 J	5.2 J	13 =	9.9 =	7.8 =	17.9 =	7.1 =	7.3 =	11 =
COBALT	MG/KG	39.41		11.4 J	12.8 =	9.5 J	11.5 =	8.2 J	10 J	7.5 J	11.4 =	8.8 J	7.7 J	5.8 J	8.2 J	10 =	10.9 J
COPPER	MG/KG	147.78	10517.84	30 =	22.1 =	25.3 =	31.5 =	21.3 =	26.4 =	21.4 =	30.6 =	29.1 =	27.7 =	21.8 =	25.7 =	28.3 =	29.1 =
IRON	MG/KG	9360.00		17800 =	15400 =	12200 =	19100 =	10600 =	16300 =	12700 =	21600 =	18500 =	17600 =	15100 =	17300 =	20600 =	21600 =
LEAD	MG/KG	4.19		3.8 =	3.3 =	6.7 =	2.1 =	13.9 =	1.7 =	1.3 =	3.2 =	1 =	3.4 =	37.2 =	2.8 =	2.6 =	4.7 =
MAGNESIUM	MG/KG			3540 =	2930 =	2950 =	4020 =	2840 =	3390 =	2440 =	3260 =	3010 =	3150 =	2020 =	2490 =	3040 =	2460 =
MANGANESE	MG/KG	2516.77	950.00	708 J	520 J	568 J	657 J	654 J	783 J	394 J	769 J	497 J	436 J	299 J	469 J	421 J	589 J
MERCURY	MG/KG	0.04	2.10	0.014 U	0.015 U	0.017 U	0.016 U	0.015 U	0.011 U	0.014 J	0.014 U	0.014 U	0.016 J	0.015 U	0.017 U	0.031 J	0.013 U
NICKEL	MG/KG	32.18	100.00	6.7 J	4.6 J	5.5 J	7.8 J	5.4 J	6.3 J	2.5 J	5.9 J	5.7 J	3.6 J	2.6 J	4.5 J	3.7 J	4.4 J
POTASSIUM	MG/KG			1630 =	1650 =	866 J	1570 =	785 J	1480 =	1230 =	1670 =	1330 =	1420 =	1170 =	821 J	1370 =	1310 =
SELENIUM	MG/KG	1.85	18.98	0.81 J	0.69 J	0.56 J	0.57 J	0.32 J	0.74 J	0.58 J	0.42 J	0.48 J	0.44 J	0.46 J	0.27 U	0.64 J	0.56 J
SODIUM	MG/KG			152 J	165 J	147 J	146 J	188 J	149 J	49.2 J	56.3 J	26.7 J	47.1 J	52 J	14.8 U	53.2 J	101 J
THALLIUM	MG/KG		3.64	1.4 J	0.87 J	0.54 J	0.83 J	0.47 J	1.3 J	0.88 J	0.81 J	0.66 J	0.55 J	0.41 J	0.35 U	0.87 J	0.65 J
VANADIUM	MG/KG	169.89	5111.02	57.7 =	48.4 =	34.6 =	62.3 =	29.9 =	46.2 =	36.9 =	61.3 =	56.3 =	49.7 =	42.9 =	50.3 =	58.7 =	63.4 =
ZINC	MG/KG	132.11	13621.80	37.8 =	30.4 =	32 =	35.9 =	23.2 =	30.2 =	24.2 =	39.8 J	29.6 J	45 J	30.9 J	28.8 J	37 J	40.2 J
Pesticides																	
p,p'-DDD	MG/KG		11.16	0.0041 U	0.0038 U	0.0037 U	0.0036 U	0.0012 J	0.004 U	0.0038 U	0.0038 UJ	0.0041 UJ	0.004 UJ	0.0036 UJ	0.0042 UJ	0.0037 UJ	0.0039 UJ
p,p'-DDT	MG/KG		1.16	0.0041 U	0.0038 U	0.0037 U	0.0036 U	0.038 =	0.004 U	0.0038 U	0.0038 UJ	0.0041 UJ	0.004 UJ	0.0036 UJ	0.0042 UJ	0.0037 UJ	0.0039 UJ
Volatiles																	
BENZENE	MG/KG		0.002	0.01 U	0.011 U	0.011 U	0.01 U	0.01 U	0.01 U	0.011 U	0.0002 J	0.0001 U	0.01 U	0.0001 U	0.011 U	0.0001 U	0.01 U
1,2-DICHLOROETHANE	MG/KG		0.001	0.0003 J	0.011 U	0.011 U	0.01 U	0.01 U	0.01 U	0.0003 U	0.0003 J	0.01 U	0.01 U	0.011 U	0.011 U	0.01 U	0.01 U
TOLUENE	MG/KG		8.79	0.01 U	0.0004 J	0.001 J	0.01 U	0.0003 J	0.01 U	0.0008 J	0.0003 J	0.0003 J	0.0003 U	0.0004 J	0.011 U	0.0003 J	0.01 U
M,P-XYLENE (SUM OF ISOMERS)	MG/KG		170.00	0.01 U	0.0004 J	0.001 J	0.01 U	0.0003 J	0.01 U	0.0007 J	0.01 U	0.0002 U	0.0002 U	0.0004 J	0.011 U	0.01 U	0.01 U
O-XYLENE (1,2-DIMETHYLBENZENE)	MG/KG		229.95	0.01 U	0.011 U	0.0004 J	0.01 U	0.01 U	0.01 U	0.0003 J	0.01 U	0.01 U	0.01 U	0.011 U	0.011 U	0.01 U	0.01 U
XYLENES, TOTAL	MG/KG		170.19	0.01 U	0.0004 J	0.001 J	0.01 U	0.0003 J	0.01 U	0.001 J	0.01 U	0.0002 U	0.0002 U	0.0004 J	0.011 U	0.01 U	0.01 U

The risk-based concentrations are based on a hazard quotient (HQ) of 0.1 and an excess lifetime cancer risk of 10 -6.
BKG = background (2 times average) values from AFWTF Camp Garcia Western Perimeter Study (November 1999)
SSL = EPA Region III Soil Screening Level for Groundwater Migration (with a dilution factor (DAF) of 20



0' 25' 50' 75' 100' 125'

LEGEND

STORM DRAIN (SD)	4" SD
TOP OF BANK	TOB
PALM TREE	
BOLLARD	
MONITORING WELL	
DROP INLET	DI
SANITARY SEWER MANHOLE	SS MH
SOIL BORING	SB-01

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Figure 8-1 SWMU-14
Sample Locations
Naval Ammunition Support Detachment, Vieques Island

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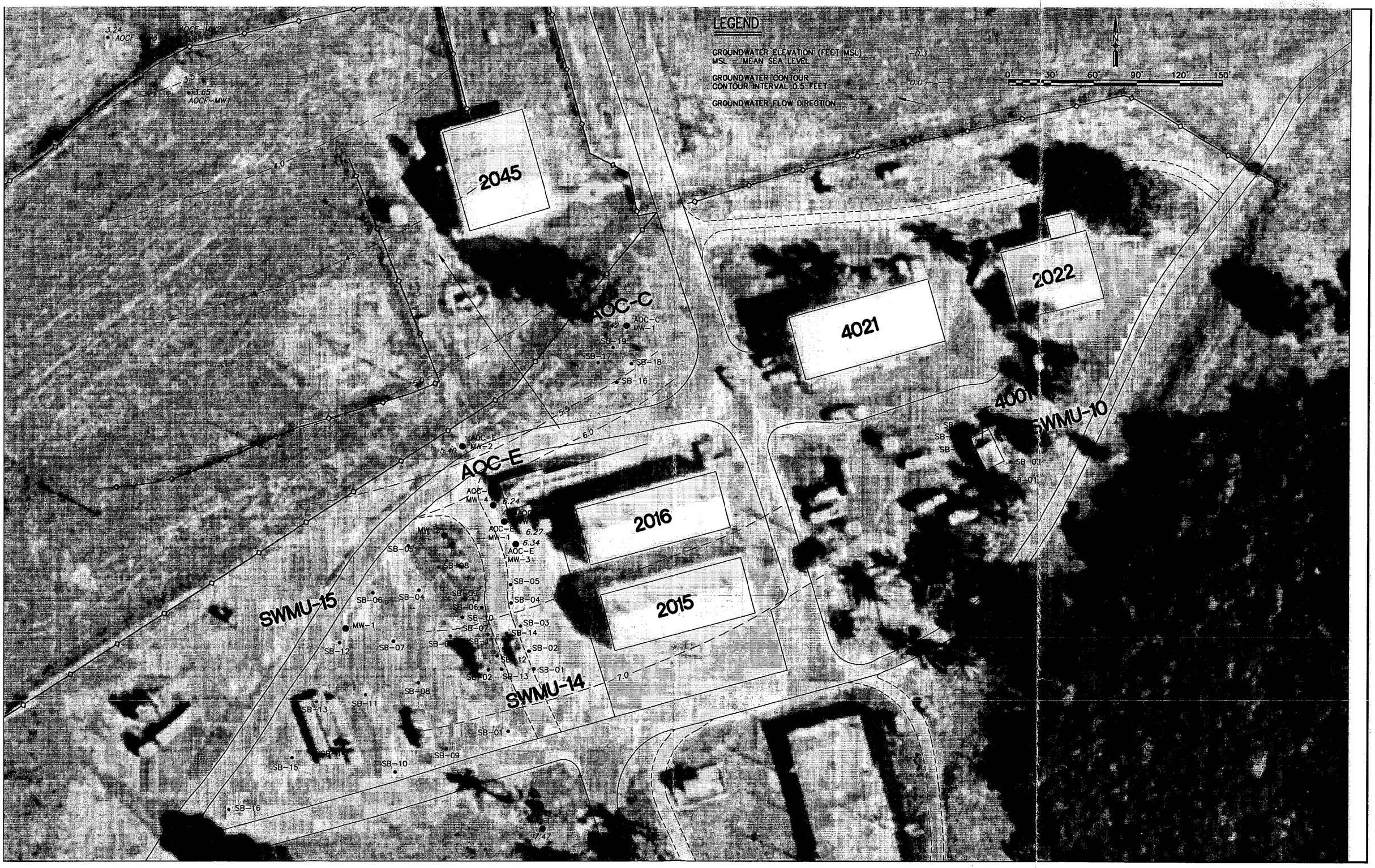

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Figure 8-2
Groundwater Flow
Naval Ammunition Support Detachment, Vieques Island

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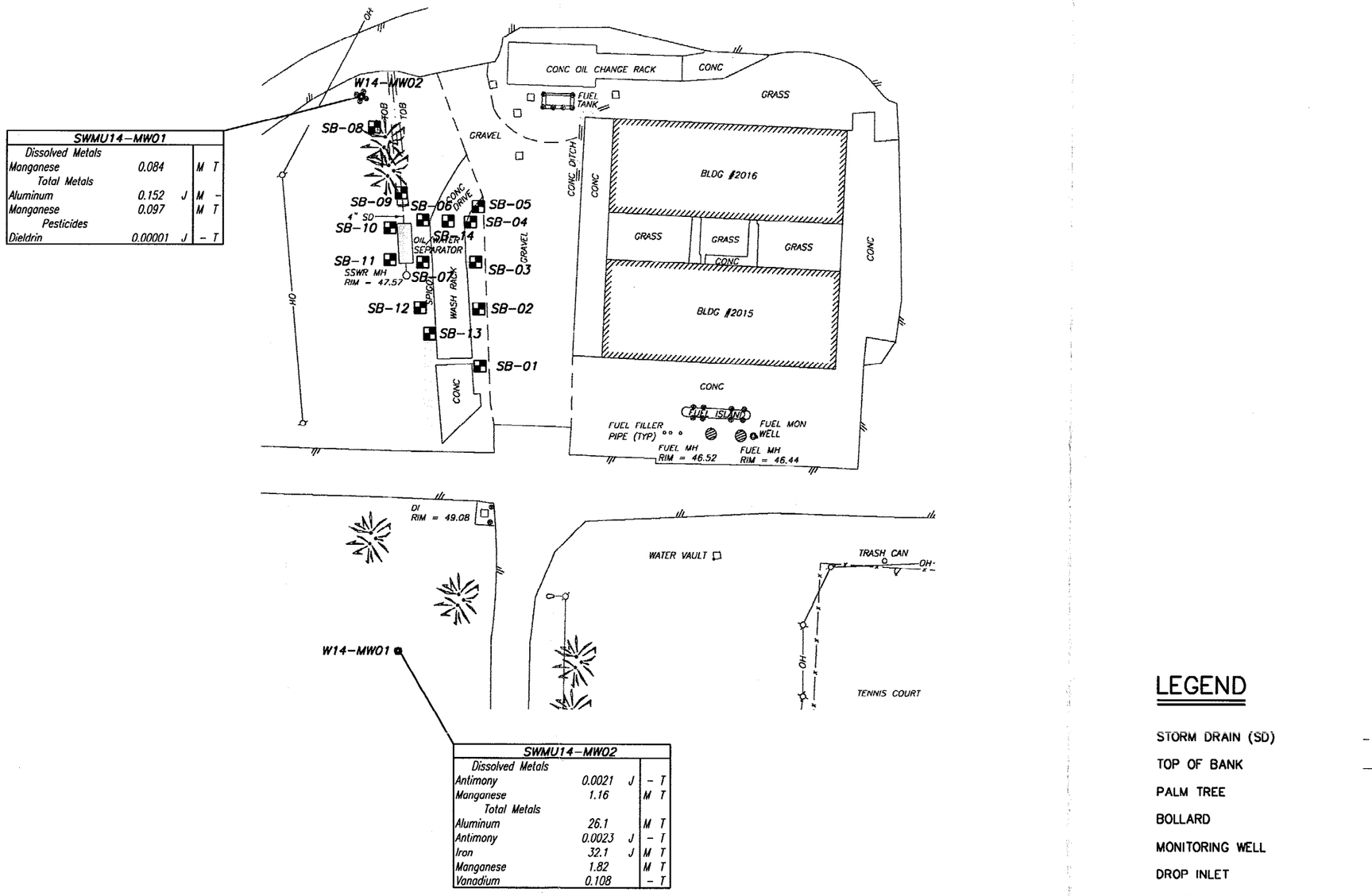

SWMU14-MW01				
Dissolved Metals				
Manganese	0.084		M	T
Total Metals				
Aluminum	0.152	J	M	–
Manganese	0.097		M	T
Pesticides				
Dieldrin	0.00001	J	–	T

SWMU14-MW02				
Dissolved Metals				
Antimony	0.0021	J	–	T
Manganese	1.16		M	T
Total Metals				
Aluminum	26.1		M	T
Antimony	0.0023	J	–	T
Iron	32.1	J	M	T
Manganese	1.82		M	T
Vanadium	0.108		–	T

LEGEND

- STORM DRAIN (SD) — 4" SD
- TOP OF BANK — TOB
- PALM TREE
- BOLLARD
- MONITORING WELL
- DROP INLET — DI
- SANITARY SEWER MANHOLE — SS MH
- SOIL BORING — SB-01

Figure 8-3 SWMU-14
Groundwater Detections Above Screening Criteria
Naval Ammunition Support Detachment, Vieques Island

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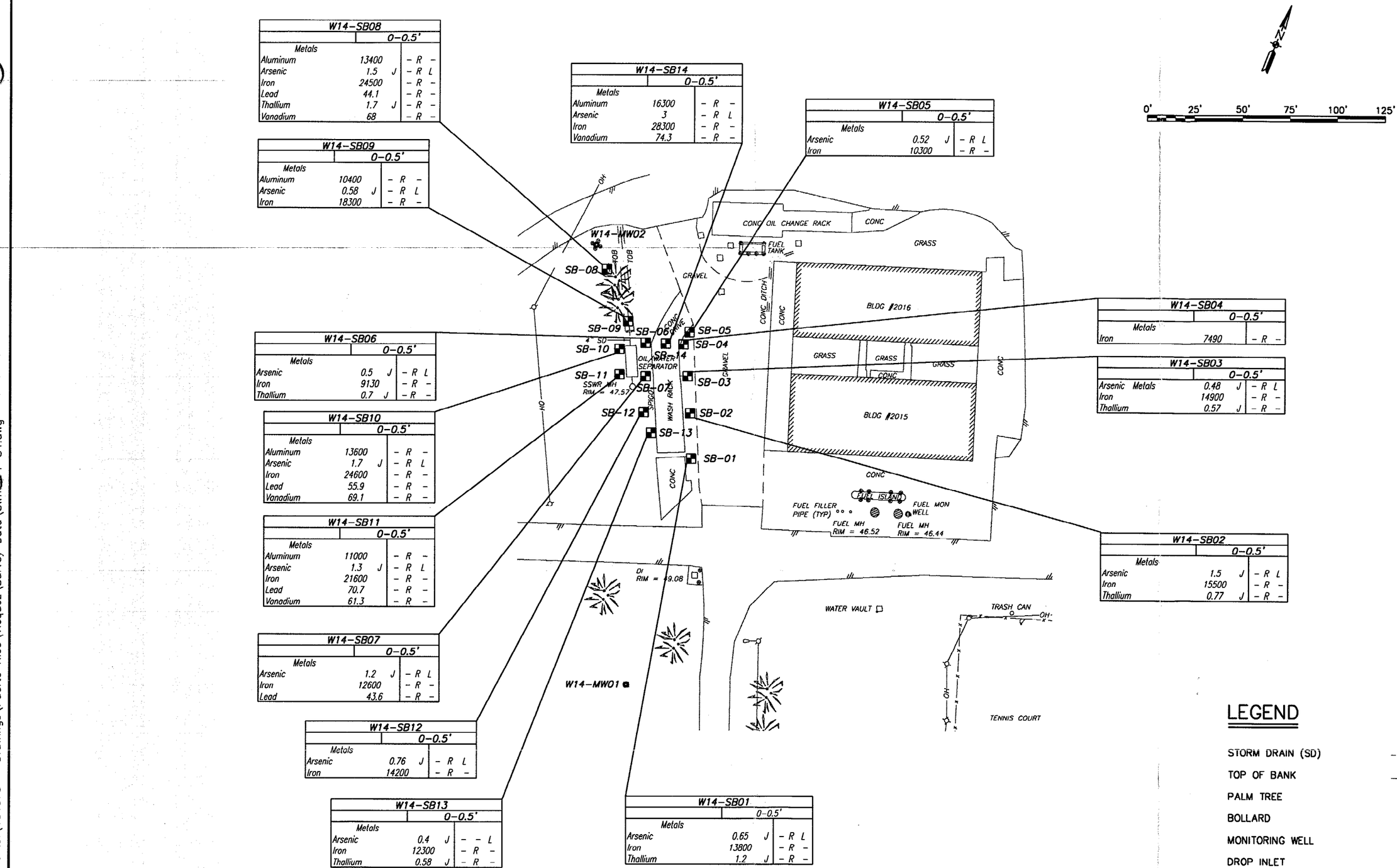

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Figure 8-4 SWMU-14
Soil Detections Above Screening Criteria
Naval Ammunition Support Detachment, Vieques Island

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SECTION 9

SWMU 15 Waste Transportation Vehicle

This section presents the results of the Expanded PA/SI investigation performed at SWMU 15 – Waste Transportation Vehicle at NASD, Vieques, Puerto Rico. The field sampling activities associated with this investigation were performed by CH2M HILL in April and May, 2000.

This section includes a description of the objectives of the Expanded PA/SI, a site description, results of previous investigations, summary of field activities, summary of laboratory results, and conclusions and recommendations. To evaluate the potential for environmental impacts from the site, data were compared to applicable regulatory screening and background values. A description of the environmental screening process was presented in Section 2.14 of this report.

9.1 Objectives

The specific objectives of this investigation were to:

1. Determine if a release of hazardous materials has occurred as a result of site-related activities; and
2. Asses whether the site is a candidate for closeout as a NFRAP site, or
3. Determine if further investigation or evaluation are warranted at this SWMU.

9.2 Site Description

This unit was a Navy truck located in the vicinity of the Transportation Shop (RFA, 1988). The truck contains numerous drums of a waste labeled as caustic DOO2 (EPA code for corrosive waste). The drums allegedly contained napalm from NSRR. The truck contained 55-gallon metal drums, and overpack drums suggesting that the material inside may have leaked at one time from a drum or another source.

9.2.1 Summary of Qualitative Ecological Survey

The plant community at this site is dominated by herbaceous species due to ongoing grounds maintenance activities (mowing) within the Public Works area. A few scattered shrubs and palm trees are present in the general area. The herbaceous plant community was dominated by several species including Bothriochloa ishaemum, Digitaria ciliaris, Cynodon dactylon, and Commelina erecta. SWMU 15 was the only site that had evidence of stressed vegetation. There was a greater abundance of Cynodon dactylon growing at this site than other sites within the Public Works area. Cynodon dactylon is an exotic and invasive grass species that can tolerate variable growing conditions. The decumbent growth form of this species indicates that this area had been compacted from heavy vehicles driving or parking on the site. The soil compaction may also limit the species diversity of the site. It appears that the site is used as a parking lot or vehicle staging area.

Wildlife observed at these sites is typical for developed areas on Vieques. Horse and mongoose were observed utilizing this site during the field survey. A few birds including a red-tailed hawk and killdeer were present during the surveys and may be expected to use portions of the habitat for feeding. Other birds that could potentially use this area include common-ground dove, scaley-naped pigeon, snowy egret, Puerto Rico woodpecker, northern mockingbird, greater antillean grackle, gray kingbird, black-whiskered vireo, white-winged dove, and zenaida dove.

There were no federally protected species or preferred habitat observed at this site. Although the Arctic peregrine falcon has been observed at NAVSTA Roosevelt Roads (U.S. Navy 1998b) on the Puerto Rico mainland within these types of grassed areas, the proximity of this habitat to buildings and human disturbance creates unfavorable conditions for the potential occurrence of this falcon.

9.3 Previous Investigation Results

No previous sampling has been conducted at this site.

9.4 PA/SI Field Investigations

PA/SI field investigations at SWMU 15 included the installation and sampling of one monitoring well and the collection of 16 surface soil samples. The samples were analyzed

for metals, VOCs, SVOCs, pesticides and PCBs. Figure 9-1 shows the soil sampling locations for SWMU 15.

9.4.1 Groundwater Sampling

One monitoring well was installed downgradient of the location in which the truck was parked to evaluate whether a release of hazardous materials to groundwater has occurred as a result of a potential leak from the drums.

9.4.2 Surface Soil Sampling

Sixteen surface soil samples (zero to 6 inches bls) were collected on a grid in the immediate area of vehicle parking lot to evaluate whether a release of hazardous materials to surface soil has occurred as a result of a potential leak from the drums.

9.5 Field Screening Results

Soil samples were screened in the field for VOCs using an OVM. This field screening method provides a qualitative evaluation of potential organic constituents in soil. The OVM results for well SWMU15-MW-1 are summarized in Appendix B. The results indicate that the OVM readings ranged from 0.0 ppm to 0.4 ppm for soil samples collected at SWMU 15, indicating that no release of organic constituents had occurred near well SWMU15-MW-1.

9.6 PA/SI Laboratory Analytical Results and Risk Based Screening Analysis

The following section presents the interpretation of the analytical data from the SWMU 15 Expanded PA/SI investigation. The discussion includes the identification of screening/regulatory criteria exceedances as well as to background criteria. Conclusions and recommendations, by media, are presented in Section 9.6.

Concentrations of detected chemicals were compared to the following current USEPA screening criteria for each matrix: residential and industrial risk-based concentrations (RBCs) and soil screening level criteria for soil; and tap water RBCs and drinking water MCLs for groundwater. Background criteria were obtained from data collected from Camp Garcia (Baker Environmental, Inc., November 1999).

Appendix J contains a compilation of the concentrations for all chemicals for which samples were analyzed. Appendix K contains a data validation summary.

9.6.1 Groundwater Results

Analytical results from unfiltered (total metals) samples indicate detections of aluminum, antimony, iron, manganese and vanadium in groundwater samples at concentrations exceeding the MCLs and/or RBCs. Filtered metals (dissolved) results show a detection of manganese above the groundwater criterion.

The detected metals in groundwater at the site were also detected in wells sampled in nearby SWMU14 and at relatively similar concentrations, indicating that the detections are likely indicative of background levels in groundwater at the site.

VOCs, SVOCs, pesticides, and PCBs were either not detected, or were detected at concentrations below their applicable screening criteria. Table 9-1 summarizes the groundwater detections, which are presented graphically on Figure 9-2.

9.6.2 Surface Soil Results

Aluminum, arsenic, chromium, iron, lead, vanadium, and thallium were detected in surface soil samples at concentrations exceeding the residential RBC and/or leachability screening criteria. These detected metals were detected in all surface soil samples at relatively similar concentrations, indicating that the detections are likely indicative of background levels in soil at the site.

VOCs, SVOCs, pesticides, and PCBs were either not detected or were detected at concentrations below their applicable screening criteria. Table 9-2 summarizes surface soil screening results, which are shown graphically on Figure 9-3.

9.7 Conclusions and Recommendations

This section summarizes the results of the Expanded PA/SI activities by media, and provides recommendations for each media sampled.

9.7.1 Groundwater

Analytical results indicate detections of dissolved metals at relatively similar concentrations to those detected in nearby monitoring wells installed and sampled as part of the SWMU 14 PA/SI, indicating that the detections are likely indicative of background conditions and are

not site-related. VOCs, SVOCs, and PCBs were either not detected or were detected at concentrations below their applicable screening criteria.

No evidence exists to suggest that a release of hazardous materials to surface soil has occurred at this site as a result of site-related activities. As a result, no additional groundwater sampling is recommended. However, a background groundwater sampling investigation for metals is recommended. Additionally, it is recommended that a Preliminary Risk Evaluation (PRE) be conducted to calculate the potential risk to human health presented by metals in groundwater at the site.

9.7.2 Surface Soil

Metals were detected in surface soil samples at concentrations indicative of site background levels. All other parameters were either not detected, or were detected below the applicable screening criteria.

No evidence exists to suggest that a release of hazardous materials to surface soil has occurred at this site as a result of site-related activities. However, a soil background investigation is recommended to confirm the background metal concentrations in the soils at NASD. Additionally, it is recommended that a Preliminary Risk Evaluation (PRE) be conducted to calculate the potential risk to human health presented by metals in surface soil at the site.

9.7.3 Institutional Controls

A chain-link fence and signs will be installed around SWMU-15 to demarcate the SWMU area. The fence and signs will remain until the CERCLA process is completed.

Table 9-1
Groundwater Analytical Data Summary
SWMU 15, NASD - Vieques, PR

	StationID				SWMU15-MW01		
	SampleID				NDA015		
	Date Collected		Screening Criteria		05/01/2000 14:30		
			Federal MCL	Tapwater RBC			
Paramater Name	**Units**	**BKG**	**(M)**	**(T)**			
Dissolved Metals							
BARIUM, DISSOLVED	MG/L	0.28	2.00	0.26	0.108	J	
CALCIUM, DISSOLVED	MG/L				72.3	=	
CADMIUM, DISSOLVED	MG/L	0.004	0.005	0.002	0.00023	J	
CHROMIUM, DISSOLVED	MG/L	0.02	0.10	0.11	0.002	J	
MAGNESIUM, DISSOLVED	MG/L				34.7	=	
MANGANESE, DISSOLVED	MG/L		0.05	0.07	0.117	=	**M T**
NICKEL, DISSOLVED	MG/L	0.02	0.10	0.07	0.0028	J	
POTASSIUM, DISSOLVED	MG/L				2.3	J	
SODIUM, DISSOLVED	MG/L				89.6	=	
VANADIUM, DISSOLVED	MG/L	0.04		0.03	0.0176	J	
ZINC, DISSOLVED	MG/L	0.14	5.00	1.10	0.0087	J	
Total Metals							
ALUMINUM	MG/L		0.05	3.65	**8.7**	=	**M T**
ANTIMONY	MG/L		0.01	0.00	**0.0015**	J	**- T**
BARIUM	MG/L	0.28	2.00	0.26	0.174	J	
BERYLLIUM	MG/L	0.0002	0.004	0.01	0.00031	J	
CALCIUM	MG/L				78.2	=	
CHROMIUM, TOTAL	MG/L	0.02	0.10	0.11	0.0308	=	
COBALT	MG/L	0.02		0.22	0.0059	J	
COPPER	MG/L	0.04	1.00	0.15	0.0148	J	
IRON	MG/L		0.30	1.10	**10.1**	=	**M T**
LEAD	MG/L		0.01		0.0017	J	
MAGNESIUM	MG/L				37.8	=	
MANGANESE	MG/L		0.05	0.07	**0.458**	=	**M T**
NICKEL	MG/L	0.02	0.10	0.07	0.0172	J	
POTASSIUM	MG/L				3.53	J	
SODIUM	MG/L				92.5	=	
VANADIUM	MG/L	0.04		0.03	**0.0435**	J	**- T**
ZINC	MG/L	0.14	5.00	1.10	0.0307	=	

Table 9-2
Surface Soil Analytical Data Summary
SWMU-15, NASD - Vieques, PR

Parameter	Units	2*BKG	Industrial RBC-I (I)	Residential RBC (R)	SSL (L)	W15-SB01 NDA178 0 To 0.5 04/11/2000 13:30	W15-SB02 NDA179 0 To 0.5 04/11/2000 13:45	W15-SB03 NDA180 0 To 0.5 04/11/2000 14:00	W15-SB04 NDA181 0 To 0.5 04/11/2000 14:15	W15-SB05 NDA182 0 To 0.5 04/11/2000 14:30	W15-SB06 NDA183 0 To 0.5 04/11/2000 14:50	W15-SB07 NDA185 0 To 0.5 04/12/2000 10:20	W15-SB08 NDA186 0 To 0.5 04/12/2000 10:30
Metals													
ALUMINUM	MG/KG		204400.00	7821.43		7810 =	7180 =	**11000 = - R -**	5720 =	**9030 = - R -**	5510 =	5030 J	5950 J
ANTIMONY	MG/KG	1.76	81.76	3.13	13.20	0.27 J	0.15 UJ	0.55 J	0.62 J	0.6 J	0.44 J	0.39 J	0.45 J
ARSENIC	MG/KG	2.08	3.82	0.43	0.03	**0.77 J - R L**	**0.72 J - R L**	**1.6 J - R L**	**0.86 J - R L**	**1.2 J - R L**	**0.62 J - R L**	**1 J - R L**	**4.8 = I R L**
BARIUM	MG/KG	167.17	14308.00	547.50	2105.32	47.2 =	57.2 =	76.7 =	62.5 =	79 =	61.6 =	64.9 =	56.2 =
BERYLLIUM	MG/KG	0.58	408.80	15.64	1153.69	0.11 J	0.15 J	0.17 J	0.14 J	0.16 J	0.11 J	0.12 J	0.092 J
CADMIUM	MG/KG	0.35	102.20	3.91	27.45	0.02 U	0.15 J	2.5 =	0.1 J	0.56 J	0.023 U	0.026 U	0.31 J
CALCIUM	MG/KG					6090 =	3450 =	15800 =	3930 =	5560 =	2570 =	1920 J	4470 J
CHROMIUM, TOTAL	MG/KG	45.92	450.00	210.00	40.00	13.9 =	9.2 =	28.4 =	10 =	18.2 =	9 =	6.6 J	13 J
COBALT	MG/KG	39.41	12264.00	469.29		8.2 J	7.3 J	11.2 =	7.8 J	10.6 J	7.8 J	7.5 J	7.6 J
COPPER	MG/KG	147.78	8176.00	312.86	10517.84	34.9 =	36.1 =	74.7 =	31.8 =	44.6 =	21.7 =	21.3 J	31.8 J
IRON	MG/KG	9360.00	61320.00	2346.43		**15300 = - R -**	**14600 = - R -**	**22200 = - R -**	**11900 = - R -**	**16400 = - R -**	**12800 = - R -**	**12200 = - R -**	**14700 = - R -**
LEAD	MG/KG	4.19	100.00	40.00		23.2 =	21.2 =	**68.4 = - R -**	**47.6 = - R -**	35.2 =	9.4 =	9.7 =	19.5 =
MAGNESIUM	MG/KG					4130 =	2100 =	6660 =	1830 =	3850 =	1930 =	1060 J	2110 J
MANGANESE	MG/KG	2516.77	4088.00	1600.00	950.00	524 =	520 =	572 =	690 =	704 =	720 =	701 =	627 =
MERCURY	MG/KG	0.04	61.32	2.35	2.10	0.014 U	0.017 J	0.11 =	0.017 U	0.038 J	0.02 J	0.015 U	0.013 U
NICKEL	MG/KG	32.18	4088.00	156.43	100.00	8.2 =	4.5 J	12.5 =	4.6 J	9.3 J	5.1 J	3.3 J	4.9 J
POTASSIUM	MG/KG					772 J	1070 J	1600 =	1080 J	1350 =	921 J	828 J	872 J
SELENIUM	MG/KG	1.85	1022.00	39.11	18.98	0.82 J	0.73 J	0.61 J	0.6 J	0.97 J	0.65 J	0.39 J	0.24 J
SODIUM	MG/KG					205 J	93.9 J	217 J	81.9 J	160 J	104 J	93.5 J	136 J
THALLIUM	MG/KG		14.31	0.55	3.64	0.28 U	0.45 J	0.28 U	0.31 U	0.32 U	0.33 J	**0.85 J - R -**	**0.76 J - R -**
VANADIUM	MG/KG	169.89	1430.80	54.75	5111.02	47.1 =	41.9 =	**62.8 = - R -**	34.6 =	46.4 =	40.6 =	36.2 J	43.5 J
ZINC	MG/KG	132.11	61320.00	2346.43	13621.80	51.8 =	219 =	195 =	53.2 =	84 =	36.4 =	26.5 J	80.4 J
PCBs													
PCB-1260 (AROCHLOR 1260)	MG/KG		2.86	0.32	0.41	0.033 U	0.035 U	0.021 J	0.037 U	0.039 U	0.037 U	0.039 UJ	0.037 UJ
Pesticides													
DIELDRIN	MG/KG		0.36	0.04	0.00	0.0034 U	0.0035 U	0.0034 U	0.0037 U	0.0039 U	0.0038 U	0.0039 UJ	0.0037 UJ
p,p'-DDE	MG/KG		16.83	1.88	35.22	0.0034 U	0.0035 U	0.00062 J	0.0037 U	0.0039 U	0.0038 U	0.0039 UJ	0.00042 J
p,p'-DDT	MG/KG		16.83	1.88	1.16	0.0034 U	0.0035 U	0.0034 U	0.0037 U	0.0039 U	0.0038 U	0.0039 UJ	0.0037 UJ
Semi-Volatiles													
DIETHYL PHTHALATE	MG/KG			6300.00	450.00	0.644 UJ	0.644 UJ	0.55 UJ	0.566 UJ	0.679 UJ	0.589 UJ	0.445 UJ	0.416 UJ
PHENANTHRENE	MG/KG			234.64	682.00	0.644 UJ	0.644 UJ	0.55 UJ	0.566 UJ	0.679 UJ	0.589 UJ	0.445 UJ	0.074 J
ANTHRACENE	MG/KG		61320.00	2346.43	465.60	0.644 UJ	0.644 UJ	0.55 UJ	0.566 UJ	0.679 UJ	0.589 UJ	0.445 UJ	0.017 J
FLUORANTHENE	MG/KG		8176.00	312.86	6254.64	0.644 UJ	0.644 UJ	0.085 J	0.566 UJ	0.679 UJ	0.051 J	0.445 UJ	0.307 J
PYRENE	MG/KG		6132.00	234.64	682.00	0.644 UJ	0.644 UJ	0.072 J	0.566 UJ	0.679 UJ	0.038 J	0.445 UJ	0.231 J
BENZYL BUTYL PHTHALATE	MG/KG			1600.00	17000.00	0.644 UJ	0.644 UJ	0.178 J	0.566 UJ	0.679 UJ	0.589 UJ	0.445 UJ	0.416 UJ
BENZO(a)ANTHRACENE	MG/KG		7.84	0.87	1.46	0.644 UJ	0.644 UJ	0.032 J	0.566 UJ	0.679 UJ	0.589 UJ	0.445 UJ	0.061 J
CHRYSENE	MG/KG		784.00	87.50	146.09	0.644 UJ	0.644 UJ	0.077 J	0.566 UJ	0.679 UJ	0.589 UJ	0.445 UJ	0.173 J
bis(2-ETHYLHEXYL) PHTHALATE	MG/KG			46.00	2900.00	0.644 UJ	0.644 UJ	0.308 J	0.566 UJ	0.679 UJ	0.589 UJ	0.445 UJ	0.416 UJ
BENZO(b)FLUORANTHENE	MG/KG		7.84	0.87	4.51	0.644 UJ	0.644 UJ	0.059 J	0.566 UJ	0.679 UJ	0.589 UJ	0.445 UJ	0.116 J
BENZO(k)FLUORANTHENE	MG/KG		78.40	8.75	45.14	0.644 UJ	0.644 UJ	0.042 J	0.566 UJ	0.679 UJ	0.589 UJ	0.445 UJ	0.098 J
BENZO(a)PYRENE	MG/KG		0.78	0.09	0.37	0.644 UJ	0.644 UJ	0.053 J	0.566 UJ	0.679 UJ	0.589 UJ	0.445 UJ	0.071 J
INDENO(1,2,3-c,d)PYRENE	MG/KG		7.84	0.87	12.73	0.644 UJ	0.644 UJ	0.55 UJ	0.566 UJ	0.679 UJ	0.589 UJ	0.445 UJ	0.053 J
BENZO(g,h,i)PERYLENE	MG/KG			0.87	12.73	0.644 UJ	0.644 UJ	0.55 UJ	0.566 UJ	0.679 UJ	0.589 UJ	0.445 UJ	0.041 J
Volatiles													
BENZENE	MG/KG		197.35	22.03	0.00	0.01 U	0.011 U	0.011 UJ	0.011 U	0.014 UJ	0.012 U	0.012 U	0.01 U
1,2-DICHLOROETHANE	MG/KG			7.00	0.00	0.01 U	0.0003 U	0.011 UJ	0.011 U	0.014 UJ	0.012 U	0.012 U	0.0003 J
TRICHLOROETHYLENE (TCE)	MG/KG		520.29	58.07	0.02	0.01 U	0.011 U	0.011 UJ	0.011 U	0.0005 J	0.012 U	0.012 U	0.01 U
TOLUENE	MG/KG		40880.00	1564.29	8.79	0.01 U	0.011 U	0.0007 J	0.011 U	0.0005 J	0.012 U	0.012 U	0.01 U
2-HEXANONE	MG/KG			310.00		0.01 U	0.011 U	0.011 UJ	0.011 U	0.014 UJ	0.012 U	0.002 J	0.01 U
ETHYLBENZENE	MG/KG		20000.00	780.00	15.00	0.01 U	0.011 U	0.0006 J	0.011 U	0.014 UJ	0.012 U	0.012 U	0.01 U
M,P-XYLENE (SUM OF ISOMERS)	MG/KG			16000.00	170.00	0.0008 J	0.011 U	0.004 UJ	0.011 U	0.001 J	0.012 U	0.0005 J	0.0008 J
O-XYLENE (1,2-DIMETHYLBENZENE)	MG/KG		408800.00	15642.86	229.95	0.01 U	0.011 U	0.0009 UJ	0.011 U	0.014 UJ	0.012 U	0.012 U	0.0002 U
STYRENE	MG/KG			1600.00	57.00	0.01 U	0.011 U	0.011 UJ	0.011 U	0.014 UJ	0.012 U	0.012 U	0.01 U
XYLENES, TOTAL	MG/KG		408800.00	15642.86	170.19	0.0008 J	0.011 U	0.004 J	0.011 U	0.001 J	0.012 U	0.0005 J	0.001 J

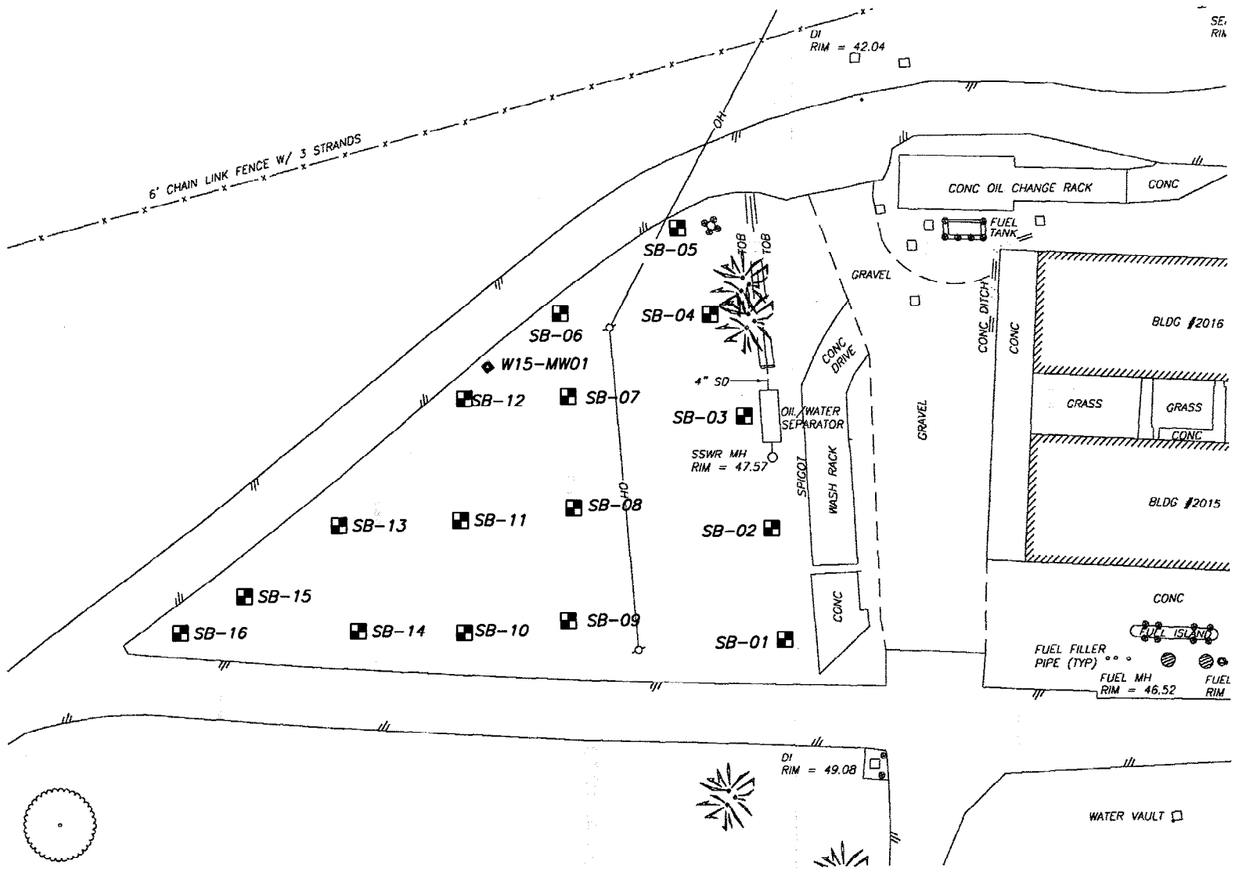
The risk-based concentrations are based on a hazard quotient (HQ) of 0.1 and an excess lifetime cancer risk of 10 -6.
BKG = background (2 times average) values from AFWTF Camp Garcia Western Perimeter Study (November 1999)
Industrial RBC = EPA Region III Risk Based Concentration for Soil (Industrial)
Residential RBC = EPA Region III Risk Based Concentration for Soil (Residential)
SSL = EPA Region III Soil Screening Level for Groundwater Migration (with a dilution factor (DAF) of 20

02021CB15Z

Table 9-2
Surface Soil Analytical Data Summary
SWMU-15, NASD - Vieques, PR

StationID		Screening Criteria				W15-SB09	W15-SB10	W15-SB11	W15-SB12	W15-SB13	W15-SB14	W15-SB15	W15-SB16
SampleID						NDA187	NDA188	NDA189	NDA190	NDA191	NDA193	NDA194	NDA195
Collection Depth						0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5
Date Collected			Industrial	Residential		04/12/2000 10:45	04/12/2000 11:15	04/12/2000 11:45	04/12/2000 12:30	04/12/2000 12:50	04/12/2000 13:20	04/12/2000 13:55	04/12/2000 14:15
Parameter	Units	2*BKG	RBC-I (I)	RBC (R)	SSL (L)								
Metals													
ALUMINUM	MG/KG		204400.00	7821.43		6550 J	6430 J	6120 J	6480 J	6900 J	9660 J - R -	9800 J - R -	21400 J - R -
ANTIMONY	MG/KG	1.76	81.76	3.13	13.20	0.23 J	0.67 J	0.43 J	0.36 J	0.36 J	0.32 J	0.84 J	0.62 J
ARSENIC	MG/KG	2.08	3.82	0.43	0.03	0.45 J - R L	1 J - R L	3.1 = - R L	0.5 J - R L	0.99 J - R L	0.58 J - R L	0.42 U	1.1 J - R L
BARIUM	MG/KG	167.17	14308.00	547.50	2105.32	58.5 =	68.8 =	79.6 =	61.7 =	65.5 =	66.3 =	73.4 =	44.4 =
BERYLLIUM	MG/KG	0.58	408.80	15.64	1153.69	0.1 J	0.13 J	0.1 J	0.091 J	0.1 J	0.1 J	0.18 J	0.13 J
CADMIUM	MG/KG	0.35	102.20	3.91	27.45	0.022 U	0.027 U	0.022 U	0.023 U	0.02 U	0.021 U	0.025 U	0.021 U
CALCIUM	MG/KG					3110 J	2990 J	3540 J	3200 J	3500 J	4550 J	3120 J	22700 J
CHROMIUM, TOTAL	MG/KG	45.92	450.00	210.00	40.00	11.3 J	10.6 J	14.7 J	11.5 J	9.4 J	13.3 J	6.7 J	47.5 J - - L
COBALT	MG/KG	39.41	12264.00	469.29		8.1 J	8.6 J	9.1 J	7.4 J	7.7 J	10 J	6.5 J	16.6 J
COPPER	MG/KG	147.78	8176.00	312.86	10517.84	32.2 J	24.5 J	46.3 J	30.8 J	22.9 J	49.6 J	27 J	66.7 J
IRON	MG/KG	9360.00	61320.00	2346.43		15400 = - R -	13700 = - R -	19700 = - R -	12900 = - R -	15000 = - R -	18500 = - R -	16700 = - R -	30100 = - R -
LEAD	MG/KG	4.19	100.00	40.00		13.5 =	6.7 =	13.3 =	66.7 = - R -	5 =	8.1 =	2.4 =	5.9 =
MAGNESIUM	MG/KG					3010 J	2290 J	1710 J	2330 J	2570 J	4870 J	2490 J	14200 J
MANGANESE	MG/KG	2516.77	4088.00	1600.00	950.00	644 =	740 =	786 =	605 =	637 =	688 =	370 =	579 =
MERCURY	MG/KG	0.04	61.32	2.35	2.10	0.015 U	0.021 J	0.014 J	0.02 J	0.014 U	0.014 U	0.015 U	0.012 U
NICKEL	MG/KG	32.18	4088.00	156.43	100.00	6.2 J	5.8 J	9.2 J	5 J	4.9 J	8.5 J	3.4 J	28.3 J
POTASSIUM	MG/KG					670 J	838 J	1110 J	778 J	876 J	874 J	1140 J	845 J
SELENIUM	MG/KG	1.85	1022.00	39.11	18.98	0.37 J	0.42 J	0.53 J	0.36 J	0.41 J	0.31 J	0.26 U	0.22 U
SODIUM	MG/KG					136 J	117 J	119 J	161 J	123 J	224 J	48.6 J	870 J
THALLIUM	MG/KG		14.31	0.55	3.64	0.45 J	0.62 J - R -	0.81 J - R -	0.34 J	0.41 J	0.52 J	0.47 J	0.28 U
VANADIUM	MG/KG	169.89	1430.80	54.75	5111.02	46.4 J	41 J	41.3 J	39.7 J	45.9 J	57.3 J - R -	46.3 J	95.9 J - R -
ZINC	MG/KG	132.11	61320.00	2346.43	13621.80	48.2 J	39.9 J	59.2 J	49.1 J	35.2 J	50.8 J	29 J	47.5 J
PCBs													
PCB-1260 (AROCHLOR 1260)	MG/KG		2.86	0.32	0.41	0.035 UJ	0.045 UJ	0.037 UJ	0.037 UJ	0.034 UJ	0.034 UJ	0.04 UJ	0.034 UJ
Pesticides													
DIELDRIN	MG/KG		0.36	0.04	0.00	0.0036 UJ	0.0046 UJ	0.0037 UJ	0.0038 UJ	0.0034 UJ	0.00045 J	0.0041 UJ	0.0034 UJ
p,p'-DDE	MG/KG		16.83	1.88	35.22	0.0036 UJ	0.0046 UJ	0.0037 UJ	0.0038 UJ	0.0034 UJ	0.0011 J	0.0041 UJ	0.0034 UJ
p,p'-DDT	MG/KG		16.83	1.88	1.16	0.0036 UJ	0.0046 UJ	0.0037 UJ	0.0038 UJ	0.0034 UJ	0.00055 J	0.0041 UJ	0.0034 UJ
Semi-Volatiles													
DIETHYL PHTHALATE	MG/KG			6300.00	450.00	0.38 UJ	0.81 UJ	0.426 UJ	0.43 UJ	0.039 J	1.72 UJ	0.48 UJ	0.323 UJ
PHENANTHRENE	MG/KG			234.64	682.00	0.38 UJ	0.81 UJ	0.426 UJ	0.43 UJ	0.338 UJ	1.72 UJ	0.48 UJ	0.323 UJ
ANTHRACENE	MG/KG		61320.00	2346.43	465.60	0.38 UJ	0.81 UJ	0.426 UJ	0.43 UJ	0.338 UJ	1.72 UJ	0.48 UJ	0.323 UJ
FLUORANTHENE	MG/KG		8176.00	312.86	6254.64	0.044 J	0.81 UJ	0.426 UJ	0.43 UJ	0.338 UJ	1.72 UJ	0.48 UJ	0.323 UJ
PYRENE	MG/KG		6132.00	234.64	682.00	0.036 J	0.81 UJ	0.426 UJ	0.43 UJ	0.338 UJ	1.72 UJ	0.48 UJ	0.323 UJ
BENZYL BUTYL PHTHALATE	MG/KG			1600.00	17000.00	0.38 UJ	0.81 UJ	0.426 UJ	0.43 UJ	0.338 UJ	1.72 UJ	0.48 UJ	0.323 UJ
BENZO(a)ANTHRACENE	MG/KG		7.84	0.87	1.46	0.38 UJ	0.81 UJ	0.426 UJ	0.43 UJ	0.338 UJ	1.72 UJ	0.48 UJ	0.323 UJ
CHRYSENE	MG/KG		784.00	87.50	146.09	0.038 J	0.81 UJ	0.426 UJ	0.43 UJ	0.338 UJ	1.72 UJ	0.48 UJ	0.323 UJ
bis(2-ETHYLHEXYL) PHTHALATE	MG/KG			46.00	2900.00	0.38 UJ	0.81 UJ	0.426 UJ	0.43 UJ	0.338 UJ	1.72 UJ	0.48 UJ	0.323 UJ
BENZO(b)FLUORANTHENE	MG/KG		7.84	0.87	4.51	0.027 J	0.81 UJ	0.426 UJ	0.43 UJ	0.338 UJ	1.72 UJ	0.48 UJ	0.323 UJ
BENZO(k)FLUORANTHENE	MG/KG		78.40	8.75	45.14	0.034 J	0.81 UJ	0.426 UJ	0.43 UJ	0.338 UJ	1.72 UJ	0.48 UJ	0.323 UJ
BENZO(a)PYRENE	MG/KG		0.78	0.09	0.37	0.38 UJ	0.81 UJ	0.426 UJ	0.43 UJ	0.338 UJ	1.72 UJ	0.48 UJ	0.323 UJ
INDENO(1,2,3-c,d)PYRENE	MG/KG		7.84	0.87	12.73	0.38 UJ	0.81 UJ	0.426 UJ	0.43 UJ	0.338 UJ	1.72 UJ	0.48 UJ	0.323 UJ
BENZO(g,h,i)PERYLENE	MG/KG			0.87	12.73	0.38 UJ	0.81 UJ	0.426 UJ	0.43 UJ	0.338 UJ	1.72 UJ	0.48 UJ	0.323 UJ
Volatiles													
BENZENE	MG/KG		197.35	22.03	0.00	0.01 U	0.0002 J	0.01 UJ	0.011 U	0.01 U	0.01 U	0.011 U	0.01 U
1,2-DICHLOROETHANE	MG/KG			7.00	0.00	0.01 U	0.013 U	0.01 UJ	0.011 U	0.01 U	0.0003 J	0.0003 J	0.01 U
TRICHLOROETHYLENE (TCE)	MG/KG		520.29	58.07	0.02	0.0003 J	0.013 U	0.01 UJ	0.011 U	0.0005 J	0.01 U	0.011 U	0.01 U
TOLUENE	MG/KG		40880.00	1564.29	8.79	0.01 U	0.013 U	0.01 UJ	0.011 U	0.01 U	0.01 U	0.011 U	0.01 U
2-HEXANONE	MG/KG			310.00		0.01 U	0.013 U	0.01 UJ	0.011 U	0.01 U	0.01 U	0.011 U	0.01 U
ETHYLBENZENE	MG/KG		20000.00	780.00	15.00	0.01 U	0.013 U	0.01 UJ	0.001 J	0.01 U	0.01 U	0.0004 J	0.01 U
M,P-XYLENE (SUM OF ISOMERS)	MG/KG			16000.00	170.00	0.001 J	0.0007 J	0.01 UJ	0.001 J	0.0007 J	0.0004 J	0.002 J	0.01 U
O-XYLENE (1,2-DIMETHYLBENZENE)	MG/KG		408800.00	15642.86	229.95	0.0005 J	0.013 U	0.01 UJ	0.0006 J	0.0003 J	0.01 U	0.0007 J	0.01 U
STYRENE	MG/KG			1600.00	57.00	0.0002 J	0.013 U	0.01 UJ	0.011 U	0.01 U	0.01 U	0.011 U	0.01 U
XYLENES, TOTAL	MG/KG		408800.00	15642.86	170.19	0.001 J	0.0007 J	0.01 UJ	0.0016 J	0.001 J	0.0004 J	0.0027 J	0.01 U

The risk-based concentrations are based on a hazard quotient (HQ) of 0.1 and an excess
BKG = background (2 times average) values from AFWTF Camp Garcia Western Perimete
Industrial RBC = EPA Region III Risk Based Concentration for Soil (Industrial)
Residential RBC = EPA Region III Risk Based Concentration for Soil (Residential)
SSL = EPA Region III Soil Screening Level for Groundwater Migration (with a dilution factor



0' 25' 50' 75' 100' 125'

LEGEND

- BITUMINOUS PAVEMENT
- OVERHEAD POWER (OH)
- FENCE
- PALM TREE
- TREE
- POWER POLE
- MONITORING WELL
- SOIL BORING (SB-01)

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Figure 9-1 SWMU-15
Sample Locations
Naval Ammunition Support Detachment, Vieques Island

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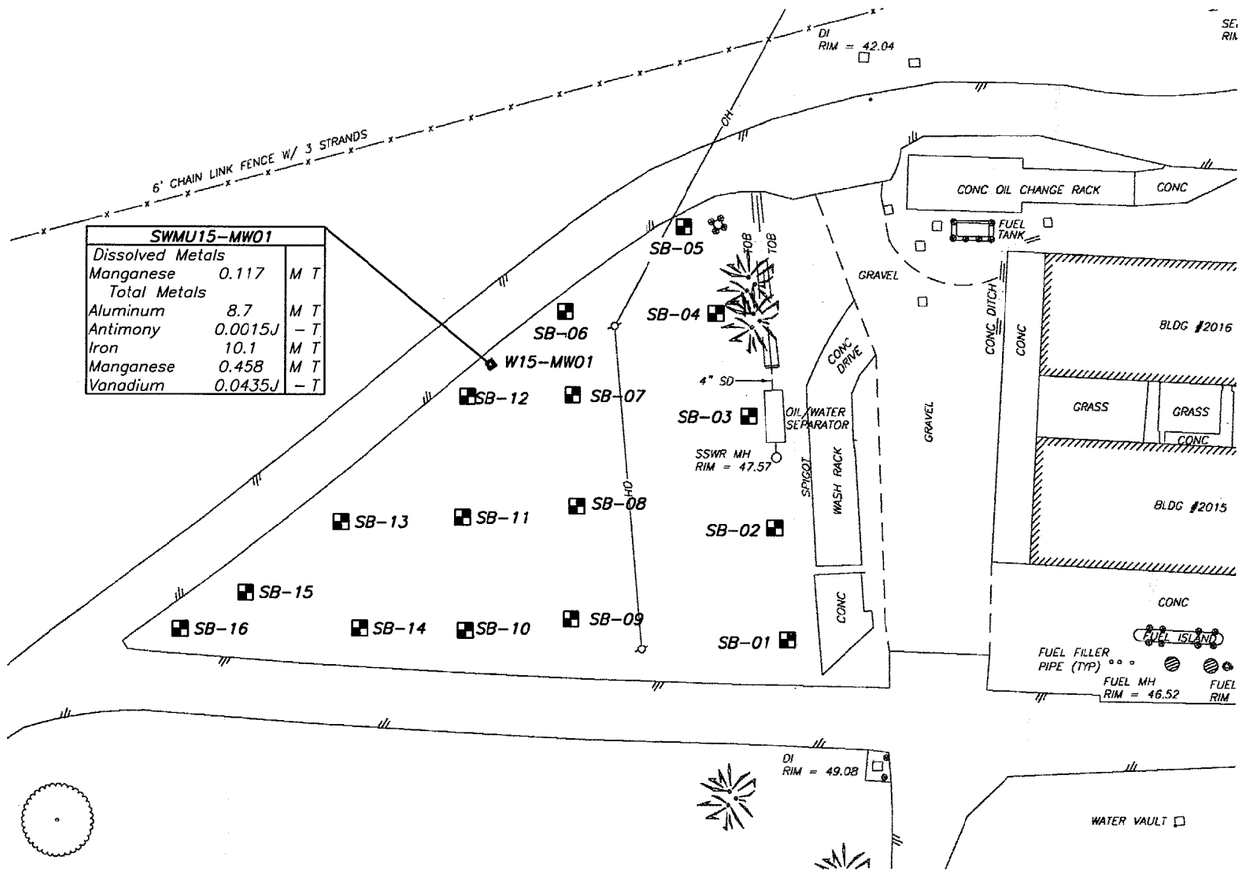

0' 25' 50' 75' 100' 125'

LEGEND

- BITUMINOUS PAVEMENT
- OVERHEAD POWER — OH —
- FENCE — x — x — x —
- PALM TREE
- TREE
- POWER POLE
- MONITORING WELL
- SOIL BORING SB-01

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Figure 9-2 SWMU-15
Groundwater Detections Above Screening Criteria
Naval Ammunition Support Detachment, Vieques Island

CH2MHILL

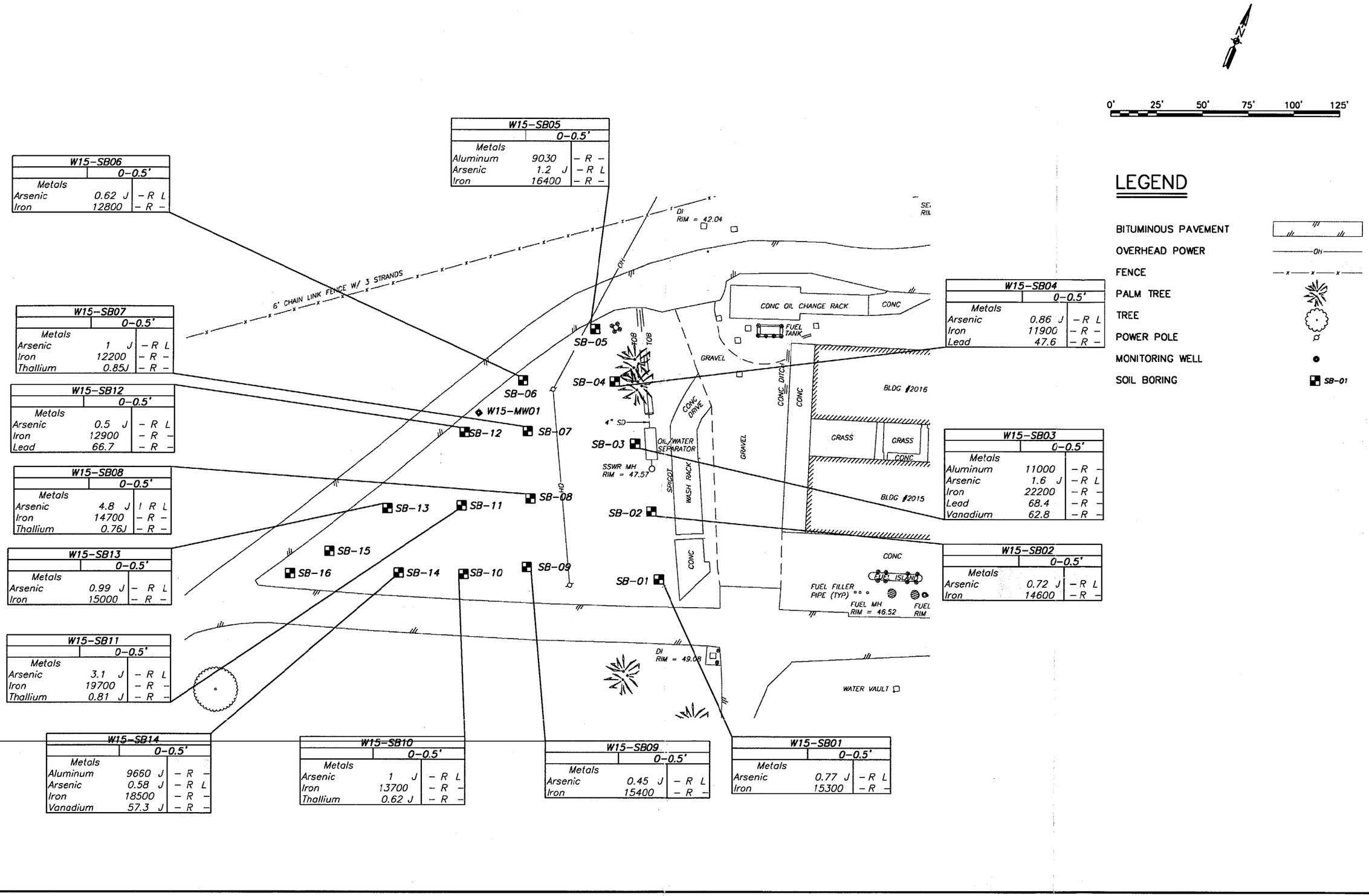

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Figure 9-3 SWMU-15
Soil Detections Above Screening Criteria
Naval Ammunition Support Detachment, Vieques Island

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SECTION 10

AOC C Drainage Ditch in the Vicinity of Transportation Shop Area

This section presents the results of the Expanded PA/SI investigation performed at AOC C - Drainage Ditch in the Vicinity of Transportation Shop Area at NASD, Vieques, Puerto Rico. The field sampling activities associated with this investigation were performed by CH2M HILL in April and May, 2000.

This section includes a description of the objectives of the Expanded PA/SI, a site description, results of previous investigations, summary of field activities, summary of laboratory results, and conclusions and recommendations. To evaluate the potential for environmental impacts from the site, data were compared to applicable regulatory screening and background values. A description of the environmental screening process was presented in Section 2.14 of this report.

10.1 Objectives

The specific objectives of this investigation were to:

1. Determine if a release of hazardous materials has occurred as a result of site-related activities; and
2. Assess whether the site is a candidate for closeout as a NFRAP site; or
3. Determine if further investigation or evaluation are warranted at this SWMU.

10.2 Site Description

Two ditches near the transportation shop routinely handle stormwater runoff during rain events. An oily sheen was observed in one of the ditches during the visual site inspection (RFA, 1988). It is unknown whether hazardous constituents have been routinely discharged to the ditch, which ultimately drains to the Atlantic Ocean. Also located in this area is a septic tank that collects the wastewater from the sink inside the Transportation Shop.

10.2.1 Summary of Qualitative Ecological Survey

Grass species are the dominant plant community at this site and within the ditches due to ongoing grounds maintenance activities (mowing) within the Public Works area. A few scattered shrubs are present in the general area but the ground cover is approximately 70 to 85 percent. The herbaceous plant community was dominated by several species, including *Bothriochloa ishaemum, Digitaria ciliaris, Cynodon dactylon,* and *Commelina erecta.* Hydrophytic vegetation was also noted in the drainage ditches on the site.

Wildlife observed at these sites is typical for developed areas on Vieques. Two mammal species (horse and mongoose) were observed using this site. Numerous birds including a red-tailed hawk, killdeer, common-ground dove, scaley-naped pigeon, snowy egret, Puerto Rico woodpecker, northern mockingbird, greater antillean grackle, gray kingbird, black-whiskered vireo, white-winged dove, and zenaida dove were present during the surveys and may be expected to use portions of the habitat for feeding.

There were no federally protected species or preferred habitat observed at this site. Although the Arctic peregrine falcon has been observed at NAVSTA Roosevelt Roads (U.S. Navy 1998b) on the Puerto Rico mainland within these types of grassed areas, the proximity of this habitat to buildings and human disturbance creates unfavorable conditions for the potential occurrence of this falcon.

10.3 Previous Investigation Results

No previous sampling has been conducted at this site.

10.4 PA/SI Field Investigations

PA/SI field investigations at AOC C included the installation and sampling of one monitoring well, collection of 15 surface soil samples, collection of 20 subsurface soil samples, and the collection of two sediment samples. The samples were analyzed for metals, VOCs, SVOCs, pesticides and PCBs. Figure 10-1 shows the soil sampling locations for AOC C.

10.4.1 Groundwater Sampling

One monitoring well was installed and sampled downgradient from an old septic tank within the ditch area to evaluate whether a release of hazardous materials from the septic tank to groundwater has occurred.

10.4.2 Surface Soil Sampling

Fifteen surface soil samples were collected along the two ditches approximately every 100 feet to evaluate whether a release of hazardous materials to the ditches has occurred.

10.4.3 Subsurface Soil Samples

Twenty subsurface soil samples were collected from around the old septic tank in the ditch area. Samples were collected from all four sides of the septic tank at depths of 5, 10, 15, 20, and 25 feet.

10.4.4 Sediment Samples

Two sediment samples were collected at the catch basins in the ditch area to evaluate whether hazardous constituents potentially present in the ditch have accumulated in the catch basins.

10.5 Field Screening Results

Soil samples were screened in the field for VOCs using an OVM. This field screening method provides a qualitative evaluation of potential organic constituents in soil. The OVM results for the site are summarized in Appendix B. The results indicate that all OVM readings were 0.0 ppm for soil samples collected at AOC C, indicating that no release of organic constituents had occurred at this site.

10.6 Laboratory Analytical Results and Risk Based Screening Analysis

The following section presents the interpretation of the analytical data from the AOC C Expanded PA/SI investigation. The discussion includes the identification of screening/regulatory criteria exceedances as well as to background criteria. Conclusions and recommendations, by media, are presented in Section 10.6.

Concentrations of detected chemicals in soil were compared to USEPA residential and industrial RBCs and soil screening level criteria. Background criteria were obtained from data collected from Camp Garcia (Baker Environmental, Inc., November 1999).

Appendix J contains a compilation of the concentrations for all chemicals for which samples were analyzed. Appendix K contains a data validation summary.

10.6.1 Groundwater Results

Analytical results from unfiltered (total metals) samples indicate detections of aluminum, iron, manganese, and vanadium in groundwater samples at concentrations exceeding the MCLs and/or RBCs. Filtered metals (dissolved) results show no detections above the groundwater criterion.

The detected metals in groundwater at the site were also detected in wells sampled in nearby SWMU14 and at relatively similar concentrations, indicating that the detections are likely indicative of background levels in soil at the site.

VOCs, SVOCs, pesticides, and PCBs were either not detected or were detected at concentrations below their applicable screening criteria. Table 10-1 summarizes the groundwater detections, which are presented graphically on Figure 10-2.

10.6.2 Surface Soil Results

Aluminum, arsenic, iron, thallium, and vanadium were detected in surface soil samples at concentrations exceeding the residential RBC and/or leachability screening criteria. These detected metals were detected in all surface soil samples at relatively similar concentrations, indicating that the detections are likely indicative of background levels in soil at the site.

VOCs, SVOCs, pesticides, and PCBs were either not detected or were detected at concentrations below their applicable screening criteria. Table 10-2 summarizes surface soil screening results, which are shown graphically on Figure 10-3.

10.6.3 Subsurface Soil Results

Arsenic and manganese were detected above leachability criteria, but below background criteria. VOCs, SVOCs, pesticides, and PCBs were either not detected or were detected at concentrations below their applicable screening criteria. Subsurface soil screening results, which are shown graphically on Figure 10-3.

10.6.4 Sediment Results

Sediment samples were collected from within concrete catch basins and are not considered media samples. Therefore, these samples were not screened against soil or sediment criteria. Zinc and dieldrin were detected in these samples. Therefore, proper management of the material will be required.

10.7 Conclusions and Recommendations

This section summarizes the results of the Expanded PA/SI activities by media, and provides recommendations for each media sampled.

10.7.1 Groundwater

Analytical results indicate detections of dissolved metals at relatively similar concentrations to those detected in nearby monitoring wells installed and sampled as part of the SWMU 14 PA/SI, indicating the detections are likely indicative of background conditions and are not site-related. VOCs, SVOCs, and PCBs were either not detected or were detected at concentrations below their applicable screening criteria.

No evidence exists to suggest that a release of hazardous materials to groundwater has occurred at this site as a result of site-related activities. As a result, no additional groundwater sampling is recommended. However, a background groundwater investigation is recommended. Additionally, it is recommended that a Preliminary Risk Evaluation (PRE) be conducted to calculate the potential risk to human health presented by metals in groundwater at the site.

10.7.2 Surface Soil

Metals were detected in surface soil samples at concentrations indicative of site background levels. All other parameters were either not detected, or were detected below the applicable screening criteria.

No evidence exists to suggest that a release of hazardous materials to surface soil has occurred at this site as a result of site-related activities. However, an additional soil background investigation is recommended to verify the background soil conditions at NASD. Additionally, it is recommended that a Preliminary Risk Evaluation (PRE) be

conducted to calculate the potential risk to human health presented by metals in surface soil at the site.

10.7.3 Subsurface Soil

Metals were detected in subsurface soil samples at concentrations below background levels. All other parameters were either not detected or were detected below the applicable screening criteria.

No evidence exists to suggest that a release of hazardous materials to subsurface soil has occurred at this site as a result of site-related activities. However, an additional soil background investigation is recommended to verify the background soil conditions of NASD.

10.7.4 Institutional Controls

Signs will be used to demarcate the AOC-C area. The signs will remain in place until the CERCLA process has been completed.

Table 10-1
Groundwater Analytical Data Summary
AOC C, NASD - Vieques, PR

StationID			Screening Criteria		AOC-C-MW01
SampleID					NDA016
Date Collected					05/01/2000 12:50
Paramater Name	Units	BKG	Federal MCL (M)	Tapwater RBC (T)	
Dissolved Metals					
BARIUM, DISSOLVED	MG/L	0.28	2.00	0.26	0.124 J
CALCIUM, DISSOLVED	MG/L				66.6 =
CHROMIUM, DISSOLVED	MG/L	0.02	0.10	0.11	0.0012 J
LEAD, DISSOLVED	MG/L		0.01		0.0014 J
MAGNESIUM, DISSOLVED	MG/L				40 =
MANGANESE, DISSOLVED	MG/L		0.05	0.07	0.0227 =
NICKEL, DISSOLVED	MG/L	0.02	0.10	0.07	0.0057 J
POTASSIUM, DISSOLVED	MG/L				4.65 J
SELENIUM, DISSOLVED	MG/L	0.02	0.05	0.02	0.0027 J
SODIUM, DISSOLVED	MG/L	0.04		0.03	155 =
VANADIUM, DISSOLVED	MG/L	0.14	5.00	1.10	0.0123 J
Metals					
ALUMINUM	MG/L		0.05	3.65	**4.39 = M T**
BARIUM	MG/L	0.28	2.00	0.26	0.156 J
CALCIUM	MG/L				70.9 =
CHROMIUM, TOTAL	MG/L	0.02	0.10	0.11	0.0167 =
COBALT	MG/L	0.02		0.22	0.0033 J
COPPER	MG/L	0.04	1.00	0.15	0.0114 J
IRON	MG/L		0.30	1.10	**5.72 = M T**
MAGNESIUM	MG/L				42.1 =
MANGANESE	MG/L		0.05	0.07	**0.177 = M T**
NICKEL	MG/L	0.02	0.10	0.07	0.0091 J
POTASSIUM	MG/L				4.98 J
SODIUM	MG/L				157 =
VANADIUM	MG/L	0.04		0.03	**0.0276 J - T**
ZINC	MG/L	0.14	5.00	1.10	0.0176 J

Table 10-2
Surface Soil Analytical Data Summary
AOC-C, NASD - Vieques, PR

Parameter	Units	2*BKG	Industrial RBC-I (I)	Residential RBC (R)	SSL (L)	AC-SB01 NDA196 0 To 0.5 04/10/2000 15:10	AC-SB02 NDA198 0 To 0.5 04/10/2000 15:45	AC-SB03 NDA199 0 To 0.5 04/10/2000 16:10	AC-SB04 NDA200 0 To 0.5 04/10/2000 16:30	AC-SB05 NDA201 0 To 0.5 04/11/2000 8:45	AC-SB06 NDA202 0 To 0.5 04/11/2000 9:15	AC-SB07 NDA203 0 To 0.5 04/11/2000 9:50	AC-SB08 NDA204 0 To 0.5 04/11/2000 10:45
Metals													
ALUMINUM	MG/KG		204400.00	7821.43		9200 = - R -	8130 = - R -	7670 =	8150 = - R -	6250 =	7860 = - R -	8910 = - R -	6600 =
ANTIMONY	MG/KG	1.76	81.76	3.13	13.20	0.15 UJ	0.18 UJ	0.18 UJ	0.15 UJ	0.14 UJ	0.19 J	0.17 UJ	0.18 UJ
ARSENIC	MG/KG	2.08	3.82	0.43	0.03	1.2 J - R L	0.44 U	2.1 J - R L	0.76 J - R L	0.35 U	0.95 J - R L	0.72 J - R L	0.48 J - R L
BARIUM	MG/KG	167.17	14308.00	547.50	2105.32	48.4 =	52.8 =	52.7 =	50.8 =	39.2 J	68.8 =	62.2 =	43.3 J
BERYLLIUM	MG/KG	0.58	408.80	15.64	1153.69	0.22 J	0.24 J	0.19 J	0.23 J	0.16 J	0.18 J	0.18 J	0.13 J
CALCIUM	MG/KG					3050 =	2230 =	2850 =	2360 =	1410 =	12600 =	4720 =	4690 =
CHROMIUM, TOTAL	MG/KG	45.92	450.00	210.00	40.00	13.5 =	7 =	11.4 =	11.5 =	7.3 =	8.5 =	11.9 =	9.7 =
COBALT	MG/KG	39.41	12264.00	469.29		8.2 J	9 J	8.3 J	8.6 J	6.6 J	9.9 J	9.6 J	6.5 J
COPPER	MG/KG	147.78	8176.00	312.86	10517.84	30.2 =	27.8 =	24.9 =	24.9 =	18.2 =	23.9 =	32.8 =	23.5 =
IRON	MG/KG	9360.00	61320.00	2346.43		18500 = - R -	17800 = - R -	14800 = - R -	21100 = - R -	11500 = - R -	14200 = - R -	15800 = - R -	14100 = - R -
LEAD	MG/KG	4.19	100.00	40.00		5.4 =	1.7 =	6.7 =	4.3 =	1.1 =	3.4 =	7.1 =	6.5 =
MAGNESIUM	MG/KG					3770 =	2620 =	2730 =	2610 =	1810 =	2190 =	3160 =	2860 =
MANGANESE	MG/KG	2516.77	4088.00	1600.00	950.00	377 =	405 =	458 =	462 =	401 =	713 =	527 =	288 =
MERCURY	MG/KG	0.04	61.32	2.35	2.10	0.014 U	0.016 U	0.018 U	0.015 U	0.013 U	0.021 J	0.025 J	0.017 U
NICKEL	MG/KG	32.18	4088.00	156.43	100.00	6.8 J	3.6 J	5.5 J	5.1 J	3.2 J	3.8 J	6.7 J	5 J
POTASSIUM	MG/KG					939 J	1340 =	1020 J	1120 =	1130 =	1290 =	1130 J	878 J
SELENIUM	MG/KG	1.85	1022.00	39.11	18.98	0.9 J	0.68 J	0.58 J	0.78 J	0.55 J	0.8 J	0.63 J	0.84 J
SODIUM	MG/KG					114 J	46.4 J	72.9 J	195 J	205 J	154 J	120 J	111 J
THALLIUM	MG/KG		14.31	0.55	3.64	0.56 J - R -	0.37 J	0.35 U	0.65 J - R -	0.28 U	0.31 U	0.52 J	0.35 U
VANADIUM	MG/KG	169.89	1430.80	54.75	5111.02	55.5 = - R -	51.3 =	44.9 =	68.4 = - R -	34.1 =	46.2 =	50.1 =	40 =
ZINC	MG/KG	132.11	61320.00	2346.43	13621.80	56.5 =	30.1 =	44.5 =	36.2 =	16.1 =	27.9 =	40.4 =	46.6 =
Pesticides													
p,p'-DDE	MG/KG		16.83	1.88	35.22	0.0036 U	0.0043 U	0.0043 U	0.00053 J	0.0033 U	0.00058 J	0.0064 =	0.0008 J
p,p'-DDD	MG/KG		23.85	2.66	11.16	0.0036 U	0.0043 U	0.0043 U	0.0035 U	0.0033 U	0.0038 U	0.0021 J	0.0043 UJ
p,p'-DDT	MG/KG		16.83	1.88	1.16	0.0036 UJ	0.0043 UJ	0.0043 UJ	0.0035 UJ	0.0033 U	0.0038 U	0.016 =	0.0043 U
Semi-Volatiles													
DI-n-BUTYL PHTHALATE	MG/KG			780.00	5000.00	0.583 U	0.579 U	0.605 U	0.473 U	0.491 UJ	0.605 UJ	0.617 UJ	0.109 J
Volatiles													
BENZENE	MG/KG		197.35	22.03	0.00	0.01 UJ	0.0001 J	0.0003 J	0.012 U	0.019 U	0.014 U	0.011 U	0.014 U
TRICHLOROETHYLENE (TCE)	MG/KG		520.29	58.07	0.02	0.01 UJ	0.011 UJ	0.014 UJ	0.012 U	0.019 U	0.014 U	0.011 U	0.014 U
TOLUENE	MG/KG		40880.00	1564.29	8.79	0.01 UJ	0.001 J	0.005 J	0.001 J	0.019 U	0.014 U	0.011 U	0.014 U
ETHYLBENZENE	MG/KG		20000.00	780.00	15.00	0.01 UJ	0.001 J	0.003 J	0.001 J	0.019 U	0.014 U	0.011 U	0.014 U
M,P-XYLENE (SUM OF ISOMERS)	MG/KG			16000.00	170.00	0.01 UJ	0.008 UJ	0.02 UJ	0.008 J	0.019 U	0.014 U	0.011 U	0.014 U
O-XYLENE (1,2-DIMETHYLBENZENE)	MG/KG		408800.00	15642.86	229.95	0.01 UJ	0.002 UJ	0.006 UJ	0.002 J	0.019 U	0.014 U	0.011 U	0.014 U
XYLENES, TOTAL	MG/KG		408800.00	15642.86	170.19	0.01 UJ	0.011 J	0.026 J	0.01 J	0.019 U	0.014 U	0.011 U	0.014 U

The risk-based concentrations are based on a hazard quotient (HQ) of 0.1 and an excess lifetime cancer risk of 10 -6.
BKG = background (2 times average) values from AFWTF Camp Garcia Western Perimeter Study (November 1999)
Industrial RBC = EPA Region III Risk Based Concentration for Soil (Industrial)
Residential RBC = EPA Region III Risk Based Concentration for Soil (Residential)
SSL = EPA Region III Soil Screening Level for Groundwater Migration (with a dilution factor (DAF) of 20

Table 10-2
Surface Soil Analytical Data Summary
AOC-C, NASD - Vieques, PR

	StationID	Screening Criteria				AC-SB09	AC-SB10	AC-SB11	AC-SB12	AC-SB13	AC-SB14	AC-SB15
	SampleID					NDA206	NDA207	NDA208	NDA209	NDA210	NDA211	NDA212
	Collection Depth		Industrial	Residential		0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5	0 To 0.5
	Date Collected		RBC-I	RBC	SSL	04/11/2000 11:20	04/11/2000 11:30	04/11/2000 11:45	04/11/2000 13:30	04/11/2000 13:50	04/11/2000 14:10	04/11/2000 14:30
Parameter	Units	2*BKG	(I)	(R)	(L)							
Metals												
ALUMINUM	MG/KG		204400.00	7821.43		9600 = - R -	5240 =	5900 =	8930 = - R -	4130 =	7890 = - R -	8280 = - R -
ANTIMONY	MG/KG	1.76	81.76	3.13	13.20	0.15 UJ	0.16 UJ	0.14 UJ	0.2 UJ	0.15 UJ	0.14 UJ	0.14 UJ
ARSENIC	MG/KG	2.08	3.82	0.43	0.03	0.36 U	0.75 J - R L	0.36 J - - L	0.5 J - R L	0.35 U	0.64 J - R L	0.56 J - R L
BARIUM	MG/KG	167.17	14308.00	547.50	2105.32	55.2 =	50.2 =	40.7 J	62.8 =	30.3 J	264 =	34.3 J
BERYLLIUM	MG/KG	0.58	408.80	15.64	1153.69	0.27 J	0.11 J	0.15 J	0.2 J	0.11 J	0.22 J	0.095 J
CALCIUM	MG/KG					2600 =	3190 =	3490 =	3280 =	1870 =	3260 =	4320 =
CHROMIUM, TOTAL	MG/KG	45.92	450.00	210.00	40.00	7.5 =	8.1 =	7 =	9.2 =	6.3 =	8.3 =	13.9 =
COBALT	MG/KG	39.41	12264.00	469.29		8.1 J	6.6 J	6.5 J	9.2 J	5.2 J	20 =	7.5 J
COPPER	MG/KG	147.78	8176.00	312.86	10517.84	29.4 =	18.1 =	19.2 =	24.8 =	13.2 =	33.9 =	27.2 =
IRON	MG/KG	9360.00	61320.00	2346.43		18300 = - R -	11500 = - R -	11800 = - R -	16400 = - R -	9770 = - R -	15400 = - R -	14200 = - R -
LEAD	MG/KG	4.19	100.00	40.00		1.4 =	3.7 =	2.1 =	3.4 =	2 =	3.2 =	8.4 =
MAGNESIUM	MG/KG					3190 =	2040 =	1840 =	2620 =	1330 =	2790 =	4200 =
MANGANESE	MG/KG	2516.77	4088.00	1600.00	950.00	414 =	436 =	349 =	520 =	249 =	2030 = - R L	397 =
MERCURY	MG/KG	0.04	61.32	2.35	2.10	0.011 U	0.011 U	0.013 U	0.016 U	0.012 U	0.014 U	0.011 U
NICKEL	MG/KG	32.18	4088.00	156.43	100.00	4 J	4.2 J	3.2 J	4.3 J	2.5 J	11.2 =	7.8 J
POTASSIUM	MG/KG					1150 =	745 J	988 J	1260 J	672 J	1260 =	768 J
SELENIUM	MG/KG	1.85	1022.00	39.11	18.98	0.74 J	0.45 J	0.42 J	0.68 J	0.67 J	0.8 J	0.71 J
SODIUM	MG/KG					96 J	90.4 J	74.8 J	172 J	78.7 J	91.4 J	144 J
THALLIUM	MG/KG		14.31	0.55	3.64	0.52 J	0.31 U	0.31 J	0.47 J	0.38 J	0.27 U	0.43 J
VANADIUM	MG/KG	169.89	1430.80	54.75	5111.02	52 =	34.8 =	36.6 =	48.9 =	32.1 =	59 = - R -	42.4 =
ZINC	MG/KG	132.11	61320.00	2346.43	13621.80	29.1 =	25.3 =	19.9 =	30.9 =	13.3 =	25.2 =	34.5 =
Pesticides												
p,p'-DDE	MG/KG		16.83	1.88	35.22	0.0034 U	0.00048 J	0.0034 U	0.0014 J	0.00094 J	0.00058 J	0.0007 J
p,p'-DDD	MG/KG		23.85	2.66	11.16	0.0034 U	0.0038 U	0.0034 U	0.0047 U	0.0034 U	0.0033 U	0.0037 U
p,p'-DDT	MG/KG		16.83	1.88	1.16	0.0034 U	0.0038 U	0.00047 J	0.00082 J	0.00081 J	0.00081 J	0.0037 U
Semi-Volatiles												
DI-n-BUTYL PHTHALATE	MG/KG			780.00	5000.00	0.529 UJ	0.669 UJ	0.52 UJ	0.57 UJ	0.545 UJ	0.742 UJ	0.651 UJ
Volatiles												
BENZENE	MG/KG		197.35	22.03	0.00	0.011 U	0.012 U	0.01 U	0.016 U	0.011 U	0.011 U	0.014 U
TRICHLOROETHYLENE (TCE)	MG/KG		520.29	58.07	0.02	0.011 U	0.012 U	0.01 U	0.016 U	0.011 U	0.0003 J	0.014 U
TOLUENE	MG/KG		40880.00	1564.29	8.79	0.011 U	0.012 U	0.01 U	0.016 U	0.011 U	0.011 U	0.014 U
ETHYLBENZENE	MG/KG		20000.00	780.00	15.00	0.011 U	0.012 U	0.01 U	0.016 U	0.011 U	0.011 U	0.014 U
M,P-XYLENE (SUM OF ISOMERS)	MG/KG			16000.00	170.00	0.011 U	0.012 U	0.01 U	0.016 U	0.0003 J	0.0003 J	0.014 U
O-XYLENE (1,2-DIMETHYLBENZENE)	MG/KG		408800.00	15642.86	229.95	0.011 U	0.012 U	0.01 U	0.016 U	0.011 U	0.011 U	0.014 U
XYLENES, TOTAL	MG/KG		408800.00	15642.86	170.19	0.011 U	0.012 U	0.01 U	0.016 U	0.0003 J	0.0003 J	0.014 U

The risk-based concentrations are based on a hazard quotient (HQ) of 0.1 and an exces
BKG = background (2 times average) values from AFWTF Camp Garcia Western Perimet
Industrial RBC = EPA Region III Risk Based Concentration for Soil (Industrial)
Residential RBC = EPA Region III Risk Based Concentration for Soil (Residential)
SSL = EPA Region III Soil Screening Level for Groundwater Migration (with a dilution factor

Table 10-3
Subsurface Soil Analytical Data Summary
DC-C, NASD - Vieques, PR

StationID			AC-SB16	AC-SB16	AC-SB16	AC-SB16	AC-SB16	AC-SB17	AC-SB17	AC-SB17	AC-SB17	AC-SB17	AC-SB18	AC-SB18	AC-SB18	AC-SB18	AC-SB18	AC-SB19	AC-SB19	AC-SB19	AC-SB19	AC-SB19
SampleID			NDA213	NDA215	NDA216	NDA217	NDA218	NDA219	NDA220	NDA221	NDA222	NDA223	NDA224	NDA225	NDA226	NDA228	NDA229	NDA230	NDA231	NDA232	NDA233	NDA234
Collection Depth			4 To 6	9 To 11	14 To 16	19 To 21	24 To 26	4 To 6	9 To 11	14 To 16	19 To 21	24 To 26	4 To 6	9 To 11	14 To 16	19 To 21	24 To 26	4 To 6	9 To 11	14 To 16	19 To 21	24 To 26
Date Collected		Screening Criteria	04/07/2000 8:00	04/07/2000 8:30	04/07/2000 8:40	04/07/2000 9:10	04/07/2000 9:45	04/07/2000 10:25	04/07/2000 10:49	04/07/2000 11:10	04/07/2000 11:35	04/07/2000 12:10	04/10/2000 10:04	04/10/2000 10:22	04/10/2000 10:45	04/10/2000 11:20	04/10/2000 11:50	04/10/2000 14:27	04/10/2000 14:44	04/10/2000 14:55	04/10/2000 15:18	04/10/2000 15:36
Parameter Name	Units	BKG / SSL (L)																				
Metals																						
ALUMINUM	MG/KG		13000 J	14300 J	6640 J	6380 J	7140 J	8370 J	11200 J	4900 J	3540 J	9580 J	8490 =	13400 =	5500 =	7720 =	5990 =	7120 =	6370 =	5450 =	3140 =	9930 =
ANTIMONY	MG/KG	1.76 / 13.20	0.16 UJ	0.16 UJ	0.15 UJ	0.16 UJ	0.15 UJ	0.2 J	0.16 UJ	0.15 UJ	0.14 UJ	0.16 UJ	0.16 UJ	0.24 J	0.17 UJ	0.17 UJ	0.18 UJ	0.17 J	0.21 J	0.16 UJ	0.15 UJ	0.16 UJ
ARSENIC	MG/KG	2.08 / 0.03	0.38 U	**0.71 J -**	0.38 U	0.39 U	0.37 U	**0.45 J -**	0.39 U	0.36 U	0.34 U	**0.55 J -**	0.39 U	0.42 U	0.4 U	0.41 U	0.45 U	**0.68 J -**	0.37 U	0.38 U	0.36 U	**0.44 J -**
BARIUM	MG/KG	167.17 / 2105.32	115 J	144 J	79.4 J	54.7 J	72.2 J	73.5 J	105 J	67.2 J	45 J	91.9 J	48.1 =	143 =	59.5 =	85.8 =	88.3 =	118 =	95 =	80.7 =	34.6 J	72.4 =
BERYLLIUM	MG/KG	0.58 / 1153.69	0.27 J	0.27 J	0.17 J	0.16 J	0.16 J	0.2 J	0.25 J	0.094 J	0.088 J	0.21 J	0.18 J	0.28 J	0.15 J	0.21 J	0.18 J	0.18 J	0.15 J	0.13 J	0.095 J	0.3 J
CALCIUM	MG/KG		3070 J	3010 J	1740 J	2320 J	2630 J	2400 J	2860 J	1550 J	2180 J	3140 J	2400 =	5330 =	3230 =	5770 =	2030 =	2300 =	2140 =	1580 =	1310 =	3400 =
CHROMIUM, TOTAL	MG/KG	45.92 / 40.00	33.3 J	13 J	6.1 J	6.7 J	7.8 J	10 J	10.8 J	4.8 J	5.7 J	8.4 J	12 =	10.6 =	7.4 =	11.9 =	7.1 =	14.3 =	7 =	6 =	6 =	11.1 =
COBALT	MG/KG	39.41	11.4 J	13.9 J	7.3 J	5.1 J	7.8 J	10 J	9.5 J	5.6 J	4 J	9 J	4.6 J	13 =	7.2 J	10.6 J	8.8 J	7.7 J	6.3 J	7 J	3.4 J	8.8 J
COPPER	MG/KG	147.78 / 10517.84	28.9 J	43.3 J	20.8 J	20.3 J	25.8 J	25.1 J	34.4 J	15.8 J	10 J	31.8 J	18.3 =	46.6 =	17.3 =	33.6 =	25.2 =	28.7 =	23.8 =	21.6 =	10 =	30.2 =
IRON	MG/KG	9360	22600 J	25500 J	14600 J	13400 J	16600 J	15300 J	21000 J	11100 J	8670 J	19900 J	14100 =	26500 =	12700 =	18900 =	15600 =	16400 =	15600 =	14700 =	8880 =	22200 =
LEAD	MG/KG	4.19	2.1 =	1.6 =	1.1 =	0.95 =	1.1 =	6.8 =	1.6 =	0.76 =	0.69 =	1.1 =	1.3 =	1.5 =	1.2 =	1.5 =	1.9 =	7 =	0.78 =	1.1 =	0.58 J	1.9 =
MAGNESIUM	MG/KG		3230 J	4510 J	2290 J	2080 J	2860 J	2610 J	3600 J	1720 J	1300 J	3710 J	2330 =	4890 =	1970 =	3730 =	2960 =	2450 =	2680 =	2470 =	1210 =	3940 =
MANGANESE	MG/KG	2516.77 / 950.00	698 J	**956 J -**	424 J	292 J	408 J	708 J	472 J	370 J	234 J	472 J	164 =	669 =	482 =	468 =	587 =	512 =	329 =	409 =	193 =	464 =
MERCURY	MG/KG	0.04 / 2.10	0.016 U	0.016 J	0.015 U	0.015 U	0.015 U	0.015 U	0.014 U	0.014 U	0.013 U	0.015 U	0.012 U	0.015 U	0.015 U	0.015 U	0.016 U	0.013 U	0.015 U	0.014 U	0.012 U	0.015 U
NICKEL	MG/KG	32.18 / 100.00	12.2 =	7.5 J	2.7 J	3 J	3.4 J	4.2 J	4.6 J	2.2 J	2 J	4.4 J	2.7 J	5.9 J	3.3 J	4.9 J	3.8 J	5.1 J	3.5 J	2.9 J	1.5 J	4.2 J
POTASSIUM	MG/KG		1700 J	2340 J	1380 J	1130 J	806 J	940 J	1240 J	981 J	699 J	934 J	1080 J	1600 =	1240 =	889 J	657 J	1060 J	788 J	1110 =	633 J	810 J
SELENIUM	MG/KG	1.85 / 18.98	0.75 J	0.89 J	0.41 J	0.25 J	0.44 J	0.46 J	0.66 J	0.33 J	0.21 U	0.78 J	0.44 J	0.77 J	0.4 J	0.94 J	0.43 J	0.69 J	0.72 J	0.72 J	0.42 J	0.77 J
SODIUM	MG/KG		159 J	174 J	106 J	104 J	77.7 J	98.4 J	108 J	92.6 J	63.4 J	173 J	103 J	438 J	111 J	174 J	180 J	84.9 J	104 J	105 J	65.4 J	172 J
THALLIUM	MG/KG	/ 3.64	1.3 J	1.7 J	0.3 U	0.48 J	1.1 J	0.55 J	0.62 J	0.54 J	0.43 J	1.9 J	0.37 J	0.34 U	0.49 J	0.5 J	0.35 U	0.36 J	0.45 J	0.75 J	0.29 U	0.73 J
VANADIUM	MG/KG	169.89 / 5111.02	65.2 J	76.8 J	45 J	39.7 J	52.6 J	44.2 J	63.3 J	33.9 J	26.1 J	59.7 J	35.3 =	76.2 =	38 =	58.8 =	49.6 =	52 =	47.3 =	41.9 =	27.4 =	68.7 =
ZINC	MG/KG	132.11 / 13621.80	33.6 =	37.2 =	22.5 =	21 =	22.4 =	36.8 =	32.7 =	15.7 =	12.1 =	28.7 =	21.1 =	39.9 =	19.2 =	28.9 =	23.3 =	37.5 =	20 =	20.9 =	11.3 =	29 =
Semi-Volatiles																						
DI-N-BUTYL PHTHALATE	MG/KG	/ 5000.00	0.485 UJ	0.527 UJ	0.537 UJ	0.54 UJ	0.505 UJ	0.38 UJ	0.542 UJ	0.501 UJ	0.459 UJ	0.527 UJ	0.51 U	0.535 U	0.631 U	0.522 U	0.586 U	0.036 J	0.471 U	0.472 U	0.459 U	0.539 U
Volatiles																						
BENZENE	MG/KG	/ 0.002	0.012 U	0.0002 J	0.01 U	0.012 U	0.01 U	0.011 U	0.012 U	0.01 U	0.01 U	0.0001 U	0.0002 J	0.0004 J	0.0001 U	0.011 U	0.012 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 UJ
1,2-DICHLOROETHANE	MG/KG	/ 0.001	0.0004 J	0.011 U	0.01 U	0.012 U	0.01 U	0.0003 U	0.012 U	0.01 U	0.01 U	0.0003 J	0.01 U	0.011 U	0.0003 J	0.011 U	0.012 U	0.0003 J	0.01 U	0.0003 J	0.0003 J	0.01 UJ
TOLUENE	MG/KG	/ 8.79	0.001 J	0.003 J	0.001 J	0.012 U	0.01 U	0.002 J	0.012 U	0.01 U	0.0009 J	0.001 J	0.004 J	0.008 J	0.011 U	0.011 U	0.012 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 UJ
TETRACHLOROETHYLENE(PCE)	MG/KG	/ 0.05	0.012 U	0.011 U	0.01 U	0.012 U	0.01 U	0.011 U	0.012 U	0.01 U	0.001 J	0.01 U	0.01 U	0.011 U	0.011 U	0.011 U	0.012 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 UJ
ETHYLBENZENE	MG/KG	/ 15.00	0.0009 J	0.003 J	0.0009 J	0.012 U	0.01 U	0.002 J	0.012 U	0.01 U	0.001 J	0.0009 J	0.003 J	0.005 J	0.011 U	0.011 U	0.012 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 UJ
M,P-XYLENE	MG/KG	/ 170.00	0.008 J	0.017 =	0.008 J	0.0003 U	0.01 U	0.01 J	0.012 U	0.01 U	0.007 J	0.006 J	0.018 =	0.028 =	0.011 U	0.011 U	0.012 U	0.01 U	0.0005 J	0.01 U	0.01 U	0.01 UJ
O-XYLENE	MG/KG	/ 229.95	0.002 J	0.005 J	0.002 J	0.012 U	0.01 U	0.003 J	0.012 U	0.01 U	0.002 J	0.001 J	0.006 J	0.007 J	0.011 U	0.011 U	0.012 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 UJ
XYLENES, TOTAL	MG/KG	/ 170.19	0.01 J	0.022 =	0.01 J	0.0003 U	0.01 U	0.013 =	0.012 U	0.01 U	0.009 J	0.007 J	0.023 =	0.035 =	0.011 U	0.011 U	0.012 U	0.01 U	0.0005 J	0.01 U	0.01 U	0.01 UJ

The risk-based concentrations are based on a hazard quotient (HQ) of 0.1 and an excess lifetime cancer risk of 10 -6.
BKG = background (2 times average) values from AFWTF Camp Garcia Western Perimeter Study (November 1999)
SSL = EPA Region III Soil Screening Level for Groundwater Migration (with a dilution factor (DAF) of 20

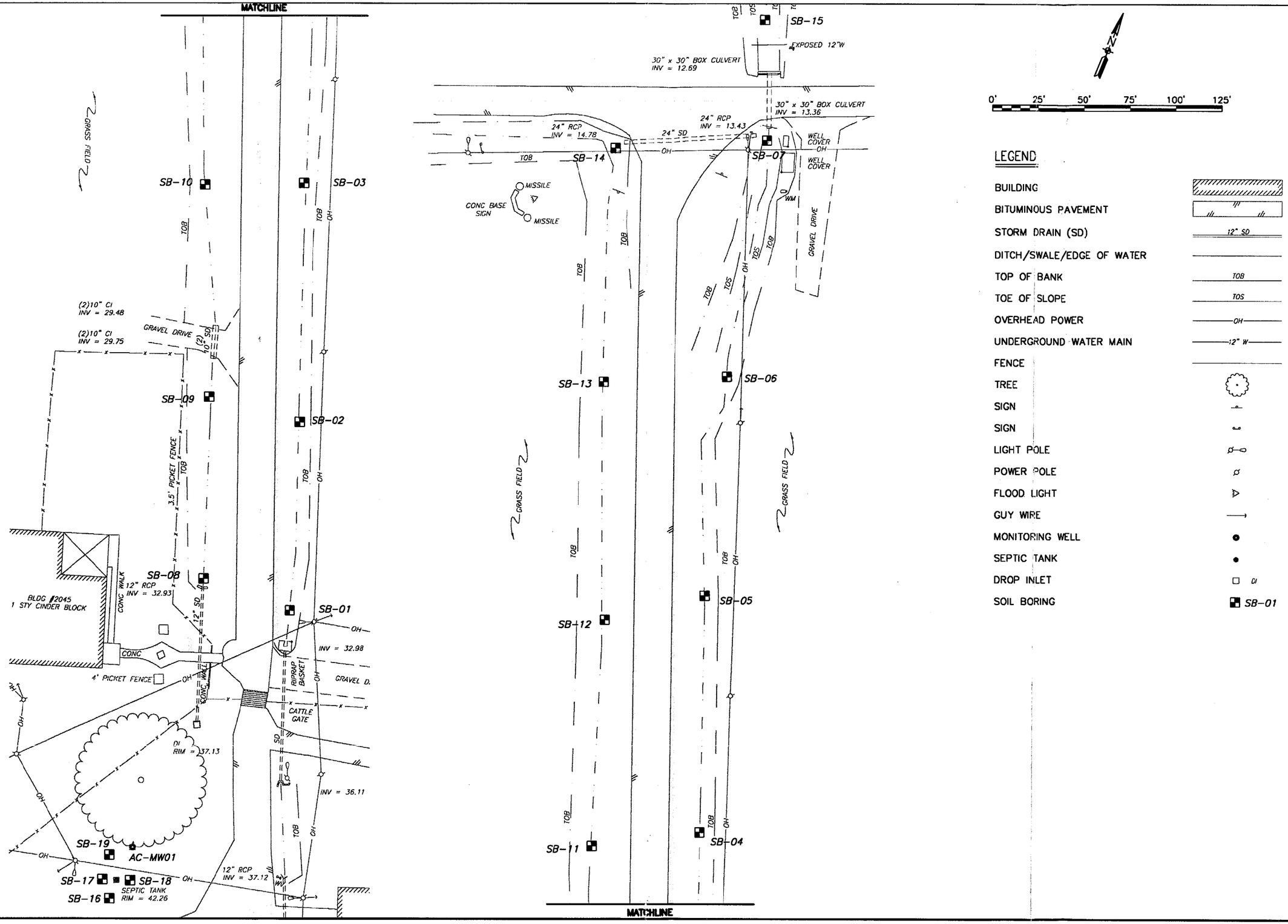

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Figure 10-1 AOC-C
Sample Locations
Naval Ammunition Support Detachment, Vieques Island

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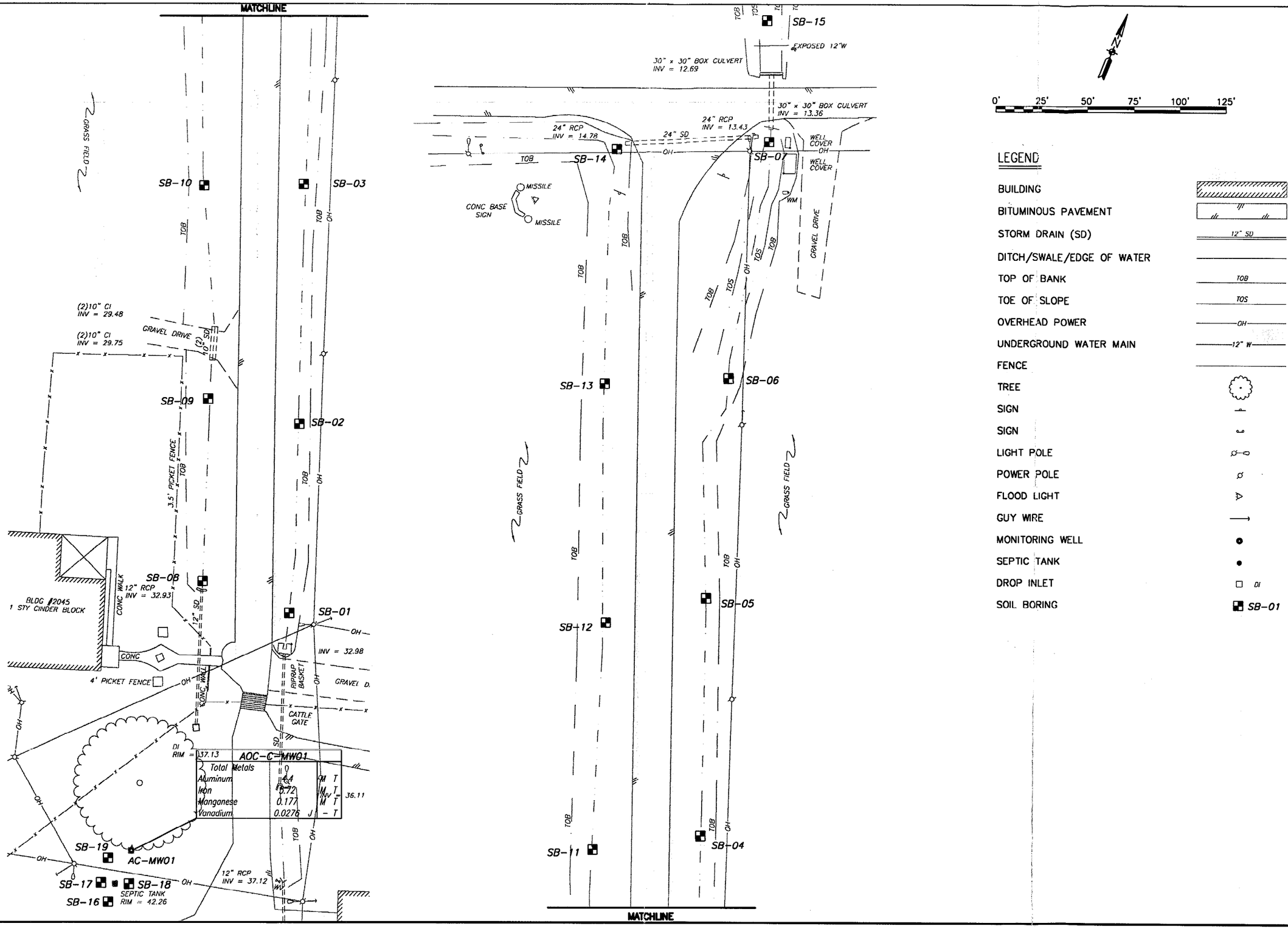

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Figure 10-2 AOC-C
Groundwater Detections Above Screening Criteria
Naval Ammunition Support Detachment, Vieques Island

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MATCHLINE

AC-SB10	0-0.5'	
Metals		
Arsenic	0.75 J	R L
Iron	11500	R –

AC-SB15	0-0.5'	
Metals		
Aluminum	8280	– R –
Arsenic	0.56 J	– R L
Iron	14200	– R –

AC-SB07	0-0.5'	
Metals		
Aluminum	8910	– R –
Arsenic	0.72 J	– R L
Iron	15800	– R –

AC-SB14	0-0.5'	
Metals		
Aluminum	7890	– R –
Arsenic	0.64 J	– R L
Iron	15400	– R –
Manganese	2030	– R –
Vanadium	59	– R –

AC-SB03	0-0.5'	
Metals		
Arsenic	2.1 J	– R L
Iron	14800	– R –

AC-SB09	0-0.5'	
Metals		
Aluminum	9600	– R –
Iron	18300	– R –

AC-SB13	0-0.5'	
Metals		
Iron	9770	– R –

AC-SB06	0-0.5'	
Metals		
Aluminum	7860	– R –
Arsenic	0.95 J	– R L
Iron	14200	– R –

AC-SB08	0-0.5'	
Metals		
Arsenic	0.48 J	– R L
Iron	14100	– R –

AC-SB02	0-0.5'	
Metals		
Aluminum	8130	– R –
Iron	17800	– R –

AC-SB01	0-0.5'	
Metals		
Aluminum	9200	– R –
Arsenic	1.2 J	– R L
Iron	18500	– R –
Thallium	0.56 J	– R –
Vanadium	55.5	– R –

AC-SB05	0-0.5'	
Metals		
Iron	11500	– R –

AC-SB12	0-0.5'	
Metals		
Aluminum	8930	– R –
Arsenic	0.5 J	– R L
Iron	16400	– R –

AC-SB04	0-0.5'	
Metals		
Aluminum	8150	– R –
Arsenic	0.76 J	– R L
Iron	21100	– R –
Thallium	0.65 J	– R –
Vanadium	68.4	– R –

AC-SB11	0-0.5'	
Metals		
Arsenic	0.36 J	– – L
Iron	11800	– R –

AC-SB16	4-6'	9-11'	14-16'	19-21'	24-26'
Metals					
Arsenic	0.71 J	–			
Manganese	956 J	–			

AC-SB17	4-6'	9-11	14-16'	19-21'	24-26'
Metals					
Arsenic	0.45 J	–		0.55 J	–

AC-SB19	4-6'	9-11'	14-16'	19-21'	24-26'
Metals					
Arsenic	0.68 J	–			0.44 J –

SB-15 EXPOSED 12"W

30" x 30" BOX CULVERT INV = 12.69

30" x 30" BOX CULVERT INV = 13.36

24" RCP INV = 14.78

24" RCP INV = 13.43

24" SD

SB-14 SB-07 SB-10 SB-03 SB-09 SB-13 SB-06 SB-02 SB-08 SB-01 SB-12 SB-05 SB-11 SB-04 SB-19 AC-MW01 SB-17 SB-18 SB-16

MISSILE CONC BASE SIGN

WELL COVER

WM

GRAVEL DRIVE

GRASS FIELD

(2)10" CI INV = 29.48

(2)10" CI INV = 29.75

(2) 10" SD

3.5' PICKET FENCE

BLDG #2045 1 STY CINDER BLOCK

CONC WALK

12" RCP INV = 32.93

12" SD

CONC

INV = 32.98

4' PICKET FENCE

RIP RAP BASKET

CATTLE GATE

INV = 36.11

12" RCP INV = 37.12

SEPTIC TANK RIM = 42.26

TOB TOS OH

0' 25' 50' 75' 100' 125'

LEGEND

- BUILDING
- BITUMINOUS PAVEMENT
- STORM DRAIN (SD) — 12" SD
- DITCH/SWALE/EDGE OF WATER
- TOP OF BANK — TOB
- TOE OF SLOPE — TOS
- OVERHEAD POWER — OH
- UNDERGROUND WATER MAIN — 12" W
- FENCE
- TREE
- SIGN
- SIGN
- LIGHT POLE
- POWER POLE
- FLOOD LIGHT
- GUY WIRE
- MONITORING WELL
- SEPTIC TANK
- DROP INLET — DI
- SOIL BORING — SB-01

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Figure 10-3 AOC-C
Soil Detections Above Screening Criteria
Naval Ammunition Support Detachment, Vieques Island

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SECTION 11

AOC E – UST Site 2016

This section presents the results of the Expanded PA/SI investigation performed at AOC E – UST Site 2016 at NASD, Vieques, Puerto Rico. The field sampling activities associated with this investigation were performed by CH2M HILL in April and May, 2000.

This section includes a description of the objectives of the Expanded PA/SI, a site description, results of previous investigations, summary of field activities, summary of laboratory results, and conclusions and recommendations. To evaluate the potential for environmental impacts from the site, data were compared to applicable regulatory screening and background values. A description of the environmental screening process was presented in Section 2.14 of this report.

11.1 Objectives

The specific objectives of this investigation were to:

1. Determine if a release of hazardous materials has occurred as a result of site-related activities; and
2. Assess whether the site is a candidate for closeout as a NFRAP site; or
3. Determine if further investigation or evaluation are warranted at this SWMU.

11.2 Site Summary

UST Site 2016 is located near the northwest corner of Building 2016 and is the former location of a 550-gallon, single-wall, steel waste oil UST. The piping system associated with the UST consisted of single-wall steel pipes. The UST was installed in 1970 to store waste oil generated from vehicle maintenance activities that take place in Building 2016.

As part of UST removal activities conducted at Site 2016, soil samples collected and submitted for laboratory analysis detected total petroleum hydrocarbon (TPH) concentration ranging from 568 to 1,790 milligrams per kilogram (mg/kg). Navy personnel indicated that no known spills associated with the UST at Site 2016 had occurred at the site.

11.2.1 Summary of Qualitative Ecological Survey

This small site is dominated by grass and herbaceous species due to ongoing grounds maintenance activities (mowing) within the Public Works area. The herbaceous plant community was dominated by several species including *Bothriochloa ishaemum, Digitaria ciliaris, Cynodon dactylon,* and *Commelina erecta.*

Wildlife observed at this site is typical for developed grassed areas on Vieques. This site is very small and offers very limited habitat for any wildlife species. Occasional common passerine birds may frequent this area but to a very limited extent.

11.3 Previous Investigation Results

A site characterization investigation was conducted by CH2M HILL and reported in April 1999 (CH2M HILL, April 1999). A total of five soil borings and three monitoring wells were installed at the site. The purpose of the site investigation was to assess the horizontal and vertical extent of potential impacts from the UST on soil and groundwater at Site 2016. Based on information obtained from the field investigation, no corrective measures were recommended. Because of exceedances of PREQB target levels in selected soil and groundwater samples, however, natural attenuation was cited for natural reduction of contaminant concentrations. Exceedances of PREQB target levels are summarized in the following subsections.

11.3.1 Groundwater

Laboratory analytical data showed the dissolved concentration of benzene detected at monitoring well AOC E-MW0 1 was 17 micrograms per liter (μg/L), which exceeds the PREQB target level of 5 μg/L. MW01 is located in the vicinity of the former UST. Dissolved concentrations of toluene, ethylbenzene, xylenes, total recoverable hydrocarbons, TPH, and polynuclear aromatic hydrocarbons were not detected above laboratory limits at any of the monitoring wells.

11.3.2 Soils

Laboratory analytical data showed that TPH was detected in soil boring SB1 (nearest to the UST) from the 45 to 47-foot interval at a concentration of 42,000 mg/kg, which is above the

PREQB target level of 100 mg/kg for this constituent. Other soil samples taken at this site were below PREQB target levels.

11.4 PA/SI Field Investigations

PA/SI field investigations at AOC E included the installation and sampling of three new monitoring wells and the collection of groundwater samples from two existing monitoring wells. The samples were analyzed for metals, VOCs, SVOCs, pesticides and PCBs. Figure 11-1 shows the soil sampling locations for AOC E.

11.4.1 Groundwater Sampling

Because of the low-level exceedances of PREQB target levels in both soil and groundwater, existing monitoring wells AOC E-MW-2 and AOC E-MW-3 were re-sampled. Existing monitoring well AOC E-MW-1 was not sampled because a thin layer (0.10 feet) of petroleum was measured in this well. Additionally, three new wells were installed downgradient of the UST to determine the extent of benzene detected within the groundwater. Groundwater flow is to the north, as shown in Figure 11-2.

11.5 Field Screening Results

Soil samples were screened in the field for VOCs using an OVM. This field screening method provides a qualitative evaluation of potential organic constituents in soil. The OVM results for the site are summarized in Appendix B. The results indicate that the OVM readings ranged from 0.0 ppm to 34.2 ppm for soil samples collected from AOC-E-MW5 at AOC E. All other samples were 0.0 ppm for soil borings AOC-E-MW4 and AOC-E-MW6.

11.6 PA/SI Laboratory Analytical Results and Risk Based Screening Analysis

The following section presents the interpretation of the analytical data from the AOC E Expanded PA/SI investigation. The discussion includes the identification of screening/regulatory criteria exceedances as well as to background criteria. Conclusions and recommendations, by media, are presented in Section 11.6.

Concentrations of detected chemicals in groundwater were compared to current USEPA tap water RBCs and drinking water MCLs. Background criteria were obtained from data collected from Camp Garcia (Baker Environmental, Inc., November 1999).

Appendix J contains a compilation of the concentrations for all chemicals for which samples were analyzed. Appendix K contains a data validation summary.

11.6.1 Groundwater Results

Free product was detected in one of the monitoring well AOC E-MW01 installed as part of the investigation. Benzene, 2-methylnaphthalene, bis(2-ethylhexyl)phthalate, naphthalene, and 1,2-dichloroethene were detected in concentrations exceeding the MCL and/or RBC in a monitoring well located immediately downgradient of the free product well. These constituents will likely be retained as potential contaminants of concern (PCOCs). The extent of the dissolved petroleum plume appears to be minimal and is bound by wells either with no detections of petroleum constituents, or detections of petroleum constituents (benzene and 2-methylnaphthalene) at concentrations below drinking water standards.

Analytical results from unfiltered (total metals) samples indicate detections of aluminum, antimony, arsenic, barium, chromium, copper, iron, manganese, nickel, and vanadium in groundwater samples at concentrations exceeding the residential RBC and/or MCLs. Filtered metals (dissolved) results show detections of aluminum, iron, and manganese above the groundwater criterion. The detected metals in groundwater at the site were detected in all wells at the site at relatively similar concentrations, indicating that the detections are likely the result of background levels in groundwater at the site.

VOCs, pesticides, and PCBs were either not detected or were detected at concentrations below their applicable screening criteria. Table 11-1 summarizes the groundwater detections, which are presented graphically on Figure 11-3.

11.7 Conclusions and Recommendations

This section summarizes the results of the Expanded PA/SI activities, and provides recommendations for further investigations.

11.7.1 Groundwater

Petroleum constituents were detected in groundwater samples collected from the site. In addition, free product was measured in monitoring well AOC E-MW 01, located in the vicinity of the UST.

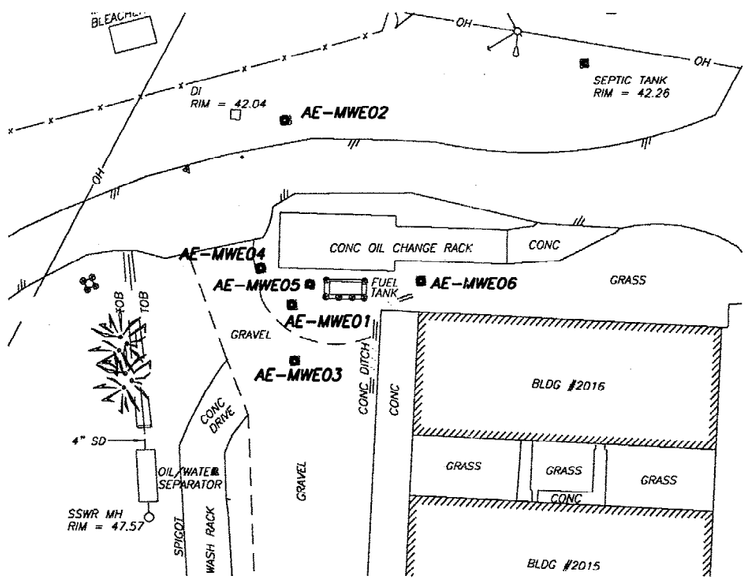
Evidence exists to suggest that a release of petroleum hydrocarbons to groundwater has occurred at this site as a result of site-related activities. Additional investigations are recommended through the Full RI/FS process to delineate the extent of the petroleum hydrocarbons within the groundwater at the site. In addition, it is recommended that the free product be remediated.

11.7.2 Institutional Controls

A chain-link fence and signs will be used to demarcate the AOC-E site. The fence and signs will remain in place until the CERCLA process has been completed.

Table 11-1
Groundwater Analytical Data Summary
AOC E, NASD - Vieques, PR

StationID					AOC-E-MWE02	AOC-E-MWE03	AOC-E-MW04	AOC-E-MW05	AOC-E-MW06
SampleID					NDA024	NDA029	NDA023	NDA026	NDA028
Date Collected			Screening Criteria		04/05/2000 15:30	04/05/2000 14:15	04/27/2000 9:45	05/01/2000 16:30	04/27/2000 9:00
			Federal MCL	Tapwater RBC					
Paramater Name	Units	BKG	(M)	(T)					
Dissolved Metals									
ALUMINUM, DISSOLVED	MG/L		0.05	3.65	0.0258 U	1.15 = M -	0.0258 U	0.0258 U	0.0258 U
BARIUM, DISSOLVED	MG/L	0.28	2.00	0.26	0.0914 J	0.129 J	0.247 =	0.173 J	0.116 J
CALCIUM, DISSOLVED	MG/L				53.7 =	59 =	99.5 J	89.4 =	50.6 J
CADMIUM, DISSOLVED	MG/L	0.0040	0.0050	0.0018	0.0002 U	0.00025 J	0.00046 J	0.00023 J	0.0002 U
CHROMIUM, DISSOLVED	MG/L	0.02	0.10	0.11	0.0017 J	0.0036 J	0.0026 J	0.0039 J	0.0018 J
COBALT, DISSOLVED	MG/L	0.02		0.22	0.0005 U	0.0013 J	0.0028 J	0.001 J	0.001 J
COPPER, DISSOLVED	MG/L	0.04	1.00	0.15	0.0019 U	0.0055 J	0.0038 J	0.0019 U	0.0025 J
IRON, DISSOLVED	MG/L		0.30	1.10	0.0173 J	1.81 = M T	0.0122 U	0.0122 U	0.0122 U
LEAD, DISSOLVED	MG/L		0.01		0.0011 U	0.0011 U	0.0016 J	0.0012 J	0.0014 J
MAGNESIUM, DISSOLVED	MG/L				31.1 =	32.4 =	45.6 =	44 =	30 =
MANGANESE, DISSOLVED	MG/L		0.05	0.07	0.0116 J	0.394 = M T	3.11 = M T	2.51 = M T	0.0231 =
NICKEL, DISSOLVED	MG/L	0.02	0.10	0.07	0.0008 U	0.0016 J	0.0063 J	0.0045 J	0.0061 J
POTASSIUM, DISSOLVED	MG/L				6.44 J	5.04 J	4.86 J	4.35 J	3.02 J
SELENIUM, DISSOLVED	MG/L	0.02	0.05	0.02	0.0021 U	0.0021 U	0.0024 J	0.0021 U	0.0046 J
SODIUM, DISSOLVED	MG/L				133 =	132 =	137 J	151 =	118 J
VANADIUM, DISSOLVED	MG/L	0.04		0.03	0.0108 J	0.0158 J	0.0122 J	0.0021 J	0.0154 J
ZINC, DISSOLVED	MG/L	0.14	5.00	1.10	0.0039 J	0.0122 J	0.0062 J	0.0036 J	0.0025 U
Total Metals									
ALUMINUM	MG/L		0.05	3.65	106 = M T	24 = M T	66 J M T	11.9 = M T	2.02 J M -
ANTIMONY	MG/L		0.01	0.00	0.0056 J - T	0.0014 U	0.0022 J - T	0.0019 J - T	0.0014 U
ARSENIC	MG/L	0.01	0.05	0.00	0.0034 U	0.0034 U	0.0034 U	0.0035 J - T	0.0034 U
BARIUM	MG/L	0.28	2.00	0.26	0.826 = - T	0.248 =	0.584 = - T	0.269 = - T	0.131 J
BERYLLIUM	MG/L	0.0002	0.004	0.01	0.00055 J	0.0003 U	0.0003 U	0.0003 U	0.0003 U
CALCIUM	MG/L				121 =	69.9 =	115 J	103 =	50.4 J
CHROMIUM, TOTAL	MG/L	0.02	0.10	0.11	0.11 = M -	0.0507 =	0.141 = M T	0.0381 =	0.01 =
COBALT	MG/L	0.02		0.22	0.118 =	0.0236 J	0.0361 J	0.0086 J	0.0011 J
COPPER	MG/L	0.04	1.00	0.15	0.247 = - T	0.0853 =	0.144 =	0.0312 =	0.0055 J
IRON	MG/L		0.30	1.10	180 = M T	39.3 = M T	66 = M T	13.8 = M T	2.02 = M T
LEAD	MG/L		0.01		0.0036 =	0.0011 J	0.0117 =	0.0018 J	0.0015 J
MAGNESIUM	MG/L				101 =	45.9 =	61.8 =	48.9 =	30.3 =
MANGANESE	MG/L		0.05	0.07	6.49 = M T	1.5 = M T	3.89 = M T	3.34 = M T	0.0652 = M -
NICKEL	MG/L	0.02	0.10	0.07	0.0651 =	0.0217 J	0.0877 = - T	0.0244 J	0.006 J
POTASSIUM	MG/L				10.4 J	6 J	12 J	5.86 J	3.3 J
SELENIUM	MG/L	0.02	0.05	0.02	0.0056 =	0.0027 J	0.0021 U	0.0021 U	0.0021 U
SODIUM	MG/L				137 =	130 =	139 J	152 =	119 J
VANADIUM	MG/L	0.04		0.03	0.489 = - T	0.12 = - T	0.175 = - T	0.0399 J - T	0.022 J
ZINC	MG/L	0.14	5.00	1.10	0.377 =	0.0953 =	0.248 =	0.0514 =	0.0032 J
Pesticides									
DIELDRIN	MG/L			0.00	0.00002 UJ	0.00003 UJ	0.00002 UJ	0.00002 U	0.00011 = - T
Semi-Volatiles									
1,2-DICHLOROBENZENE	MG/L			0.05	0.001 U	0.001 U	0.003 =	0.004 =	0.001 U
NAPHTHALENE	MG/L			0.00	0.005 U	0.005 U	0.005 U	0.015 = - T	0.006 U
2-METHYLNAPHTHALENE	MG/L			0.01	0.005 U	0.005 U	0.005 U	0.014 = - T	0.006 U
FLUORENE	MG/L			0.02	0.005 U	0.005 U	0.005 U	0.0005 J	0.006 U
DIETHYL PHTHALATE	MG/L			29.00	0.005 U	0.005 U	0.0006 J	0.006 U	0.006 U
PHENANTHRENE	MG/L			0.01	0.005 U	0.005 U	0.005 U	0.0006 J	0.006 U
DI-n-BUTYL PHTHALATE	MG/L			3.70	0.005 U	0.0007 J	0.005 U	0.0006 U	0.006 U
BENZYL BUTYL PHTHALATE	MG/L			7.30	0.005 U	0.005 U	0.005 U	0.0004 J	0.006 U
bis(2-ETHYLHEXYL) PHTHALATE	MG/L			0.00	0.001 J	0.002 J	0.005 U	0.006 U	0.006 U
Volatiles									
1,2-DICHLOROBENZENE	MG/L			0.05	0.001 U	0.001 U	0.003 =	0.004 =	0.001 U
ACETONE	MG/L			0.06	0.005 R	0.005 R	0.012 =	0.005 U	0.01 =
BENZENE	MG/L		0.00	0.00	0.001 U	0.001 U	0.002 = - T	0.006 = M T	0.001 U
1,2-DICHLOROETHANE	MG/L		0.00	0.00	0.001 U	0.001 U	0.001 U	0.032 = M T	0.001 U
TOLUENE	MG/L		1.00	0.07	0.001 U	0.001 U	0.001 U	0.0003 J	0.001 U
ETHYLBENZENE	MG/L		0.70	0.13	0.001 U	0.001 U	0.001 U	0.0009 J	0.001 U
M,P-XYLENE (SUM OF ISOMERS)	MG/L		10.00	1.22	0.001 U	0.001 U	0.0009 J	0.017 =	0.001 U
O-XYLENE (1,2-DIMETHYLBENZENE)	MG/L		10.00	1.22	0.001 U	0.001 U	0.001 U	0.003 =	0.001 U
XYLENES, TOTAL	MG/L		10.00	1.22	0.001 U	0.001 U	0.0009 J	0.02 =	0.001 U



0' 25' 50' 75' 100' 125'

LEGEND

- BUILDING
- BITUMINOUS PAVEMENT
- DITCH/SWALE/EDGE OF WATER
- FENCE
- BOLLARD
- MONITORING WELL

Figure 11-1 AOC-E
Sample Locations
Naval Ammunition Support Detachment, Vieques Island

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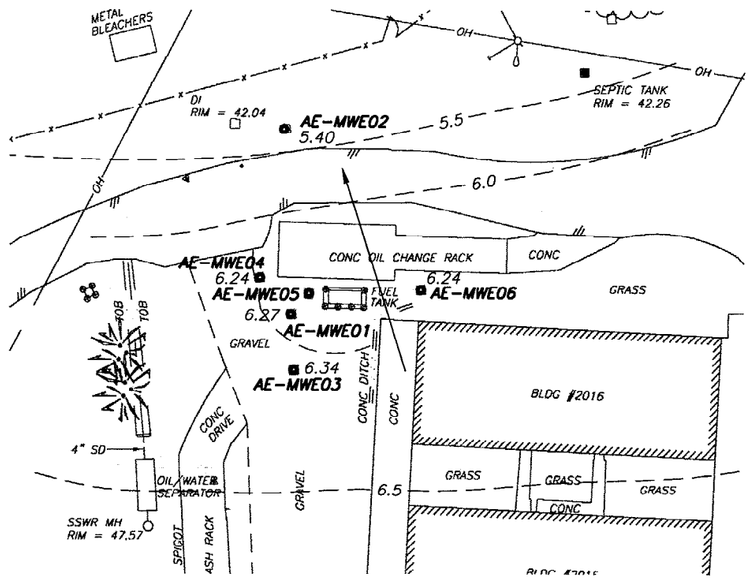

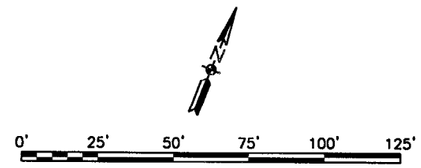

LEGEND

- BUILDING
- BITUMINOUS PAVEMENT
- DITCH/SWALE/EDGE OF WATER
- FENCE
- BOLLARD
- MONITORING WELL
- GROUNDWATER ELEVATION (FEET MSL) MSL = MEAN SEA LEVEL — -0.3
- GROUNDWATER CONTOUR CONTOUR INTERVAL 0.5 FEET — 0.0
- GROUNDWATER FLOW DIRECTION

Figure 11-2 AOC-E
Groundwater Flow
Naval Ammunition Support Detachment, Vieques Island

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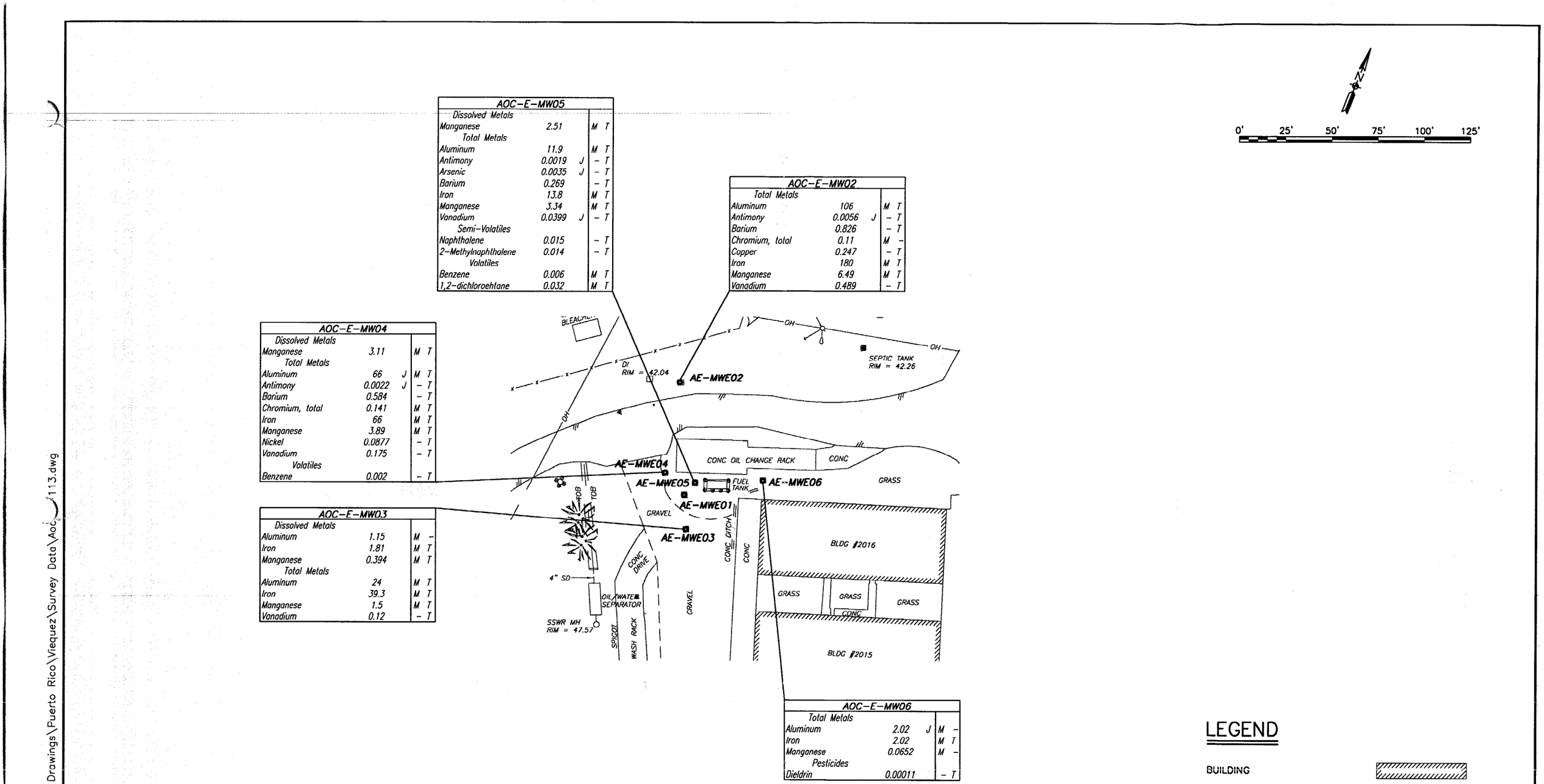

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Figure 11-3 AOC-E
Groundwater Detections Above Screening Criteria
Naval Ammunition Support Detachment, Vieques Island

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SECTION 12

AOC F UIC Septic System Site

This section presents the results of the Expanded PA/SI investigation performed at AOC F – UIC Septic Tank System at NASD, Vieques, Puerto Rico. The field sampling activities associated with this investigation were performed by CH2M HILL in April and May, 2000.

This section includes a description of the objectives of the Expanded PA/SI, a site description, results of previous investigations, summary of field activities, summary of laboratory results, and conclusions and recommendations. To evaluate the potential for environmental impacts from the site, data were compared to applicable regulatory screening and background values. A description of the environmental screening process was presented in Section 2.14 of this report.

12.1 Objectives

The specific objectives of this investigation were to:

1. determine if a release of hazardous materials has occurred as a result of site-related activities; and
2. Assess whether the site is a candidate for closeout as a NFRAP site; or
3. Determine if further investigation or evaluation are warranted at this SWMU.

12.2 Site Description

The UIC is located near the Enlisted Men's (EM) Club and has a capacity of 1,500 gallons. In 1997, this UIC was scheduled to be closed. A sampling and testing program was conducted in July 1997. Results of the soil sampling showed exceedances of water quality standards for several parameters.

12.2.1 Summary of Qualitative Ecological Survey

The plant community at this site is dominated by herbaceous species due to ongoing grounds maintenance activities (mowing) within the Public Works area. The herbaceous

plant community was dominated by several species, including *Bothriochloa ishaemum, Digitaria ciliaris, Cynodon dactylon,* and *Commelina erecta.*

Wildlife observed at these sites is typical for developed areas on Vieques. Two mammal species (horse and mongoose) were observed at the site. Many birds including a red-tailed hawk, killdeer, common-ground dove, scaley-naped pigeon, snowy egret, Puerto Rico woodpecker, northern mockingbird, greater antillean grackle, gray kingbird, black-whiskered vireo, white-winged dove, and zenaida dove were observed present during the survey and may be expected to use portions of the habitat for feeding.

There were no federally protected species or preferred habitat observed at this site. Although the Arctic peregrine falcon has been observed at NAVSTA Roosevelt Roads (U.S. Navy 1998b) on the Puerto Rico mainland within these types of grassed areas, the proximity of this habitat to buildings and human disturbance creates unfavorable conditions for the potential occurrence of this falcon.

12.3 Previous Investigation Results

Soil samples were collected in July 1997. The results of the sampling indicated several metals present at concentrations that exceeded screening criteria.

12.4 PA/SI Field Investigations

PA/SI field investigations at AOC F included the installation and sampling of five monitoring well and the collection of 20 subsurface soil samples. The samples were analyzed for metals, VOCs, SVOCs, pesticides, and PCBs. Figure 12-1 shows the groundwater and soil sampling locations for AOC F.

12.4.1 Groundwater Sampling

Five monitoring wells were installed in the vicinity of the tank. One well was installed upgradient of the tank and four monitoring wells were installed downgradient of the tank to further evaluate detection of metals discovered during the 1997 investigation. Groundwater flow is to the north, as shown in Figure 12-2.

12.4.2 Subsurface Soil Sampling

Twenty subsurface soil samples were collected from four soil borings conducted on the four sides of the septic tank. The subsurface soil samples were collected from depths of 5, 10, 15, 20, and 25 feet.

12.5 Field Screening Results

Soil samples were screened in the field for VOCs using an OVM. This field screening method provides a qualitative evaluation of potential organic constituents in soil. The OVM results for the site are summarized in Appendix B. Results indicate that all OVM readings were 0.0 ppm for soil samples collected at AOC F, indicating that no release of organic constituents had occurred at this site.

12.6 PA/SI Laboratory Analytical Results and Risk Based Screening Analysis

The following section presents the interpretation of the analytical data from the SWMU 15 Expanded PA/SI investigation. The discussion includes the identification of screening/regulatory criteria exceedances, as well as to background criteria. Conclusions and recommendations, by media, are presented in Section 12.6.

Concentrations of detected chemicals were compared to the following current USEPA screening criteria for each matrix: residential and industrial risk-based concentrations (RBCs) and soil screening level criteria for soil; and tap water RBCs and drinking water MCLs for groundwater.

Background criteria were obtained from data collected from Camp Garcia (Baker Environmental, Inc., November 1999).

Appendix J contains a compilation of the concentrations for all chemicals for which samples were analyzed. Appendix K contains a data validation summary.

12.6.1 Groundwater Results

Analytical results from unfiltered (total metals) samples indicate detections of aluminum, antimony, iron, manganese, and vanadium in groundwater samples at concentrations

exceeding the MCLs and/or tap water RBCs. Filtered metals (dissolved) results show detections of manganese above the MCLs and tap water RBCs.

The detected metals in groundwater at the site were detected in all wells sampled at the site and at relatively similar concentrations, indicating that the detections are likely indicative of background levels in groundwater at the site.

VOCs, SVOCs, pesticides, and PCBs were either not detected or were detected at concentrations below their applicable screening criteria. Table 12-1 summarizes the groundwater detections, which are presented graphically on Figure 12-3.

12.6.2 Subsurface Soil Results

Analytical results indicate detections of arsenic, chromium, and manganese in subsurface soil samples at concentrations above the leachability criteria. The detected metals in soil at the site were detected in all subsurface soil samples collected at the site and at relatively similar concentrations, indicating that the detections are likely indicative of background levels in groundwater at the site.

VOCs, SVOCs, pesticides, and PCBs were either not detected or were detected at concentrations below their applicable screening criteria. Table 12-2 summarizes surface soil screening results, which are shown graphically on Figure 12-4.

12.7 Conclusions and Recommendations

This section summarizes the results of the Expanded PA/SI activities by media, and provides recommendations for each media sampled.

12.7.1 Groundwater

Analytical results indicate detections of dissolved metals at relatively similar concentrations in all wells, indicating that the detections are likely the result of background conditions and are not site-related. VOCs, SVOCs, and PCBs were either not detected or were detected at concentrations below their applicable screening criteria.

No evidence exists to suggest that a release of hazardous materials to surface soil has occurred at this site as a result of site-related activities. As a result, no additional groundwater investigations are recommended. However, a background groundwater investigation is recommended. Additionally, it is recommended that a Preliminary Risk

Evaluation (PRE) be conducted to calculate the potential risk to human health presented by metals in groundwater at the site.

12.7.2 Subsurface Soil

Metals were detected in subsurface soil samples at concentrations indicative of site background levels. All other parameters were either not detected or were detected below the applicable screening criteria.

No evidence exists to suggest that a release of hazardous materials to subsurface soil has occurred at this site as a result of site-related activities. However, a soil background investigation is recommended to characterize the soil background conditions at NASD. Additionally, it is recommended that a Preliminary Risk Evaluation (PRE) be conducted to calculate the potential risk to human health presented by metals in subsurface soil at the site.

12.7.3 Institutional Controls

Signs will be used to demarcate the AOC-F site. The signs will remain in place until the CERCLA process has been completed.

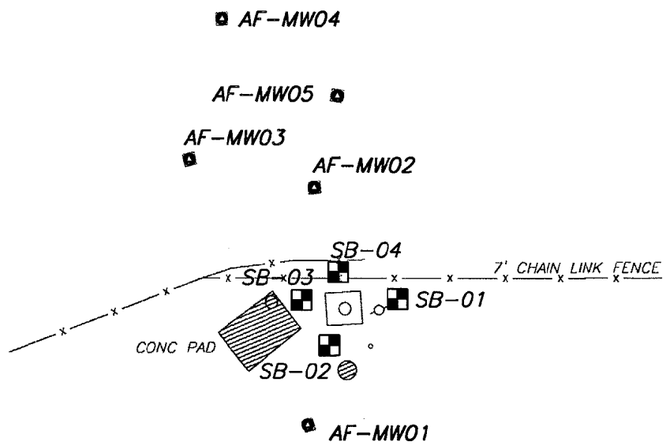
Table 12-1
Groundwater Analytical Data Summary
AOC F, NASD - Vieques, PR

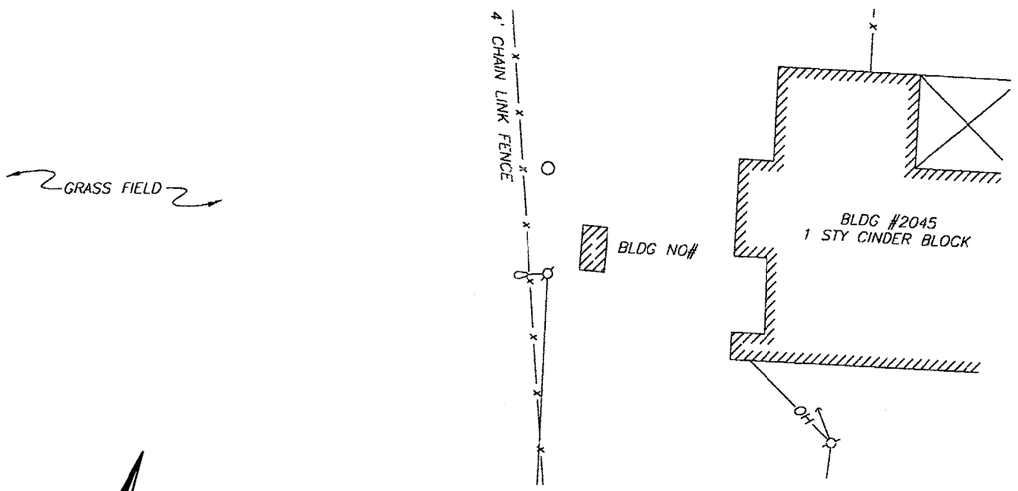
StationID					AOC-F-MW01	AOC-F-MW02	AOC-F-MW03	AOC-F-MW04	AOC-F-MW05
SampleID					NDA017	NDA019	NDA020	NDA021	NDA022
Date Collected		Screening Criteria			04/19/2000 14:00	04/25/2000 11:00	04/25/2000 13:35	04/25/2000 13:50	04/20/2000 14:45
Paramater Name	Units	BKG	Federal MCL (M)	Tapwater RBC (T)					
Dissolved Metals									
ANTIMONY, DISSOLVED	MG/L		0.01	0.001	0.0014 U	0.0014 U	0.0014 U	0.0014 U	0.0019 J
BARIUM, DISSOLVED	MG/L	0.28	2.00	0.26	0.0578 J	0.0704 J	0.0591 J	0.0705 J	0.0553 J
CALCIUM, DISSOLVED	MG/L				45.1 =	40.4 =	38.4 =	48.6 =	42.7 =
CADMIUM, DISSOLVED	MG/L	0.0040	0.0050	0.0018	0.0002 U	0.0002 J	0.0002 J	0.0002 U	0.0002 U
CHROMIUM, DISSOLVED	MG/L	0.02	0.10	0.11	0.0009 J	0.00093 J	0.001 J	0.0023 J	0.00092 J
COPPER, DISSOLVED	MG/L	0.04	1.00	0.15	0.0026 J	0.0028 J	0.0029 J	0.0038 J	0.0028 J
LEAD, DISSOLVED	MG/L		0.01		0.0011 U	0.0011 J	0.0017 J	0.0013 J	0.0011 U
MAGNESIUM, DISSOLVED	MG/L				28.3 =	26.6 =	25.3 =	34.9 =	28.9 =
MANGANESE, DISSOLVED	MG/L		0.05	0.07	0.142 = M T	0.0202 =	0.107 = M T	0.155 = M T	0.122 = M T
NICKEL, DISSOLVED	MG/L	0.02	0.10	0.07	0.0008 U	0.0016 J	0.0015 J	0.0018 J	0.001 J
POTASSIUM, DISSOLVED	MG/L				3.41 J	3.53 J	3.38 J	3.89 J	4.12 J
SELENIUM, DISSOLVED	MG/L	0.02	0.05	0.02	0.0021 U	0.006 =	0.0036 J	0.0059 =	0.0067 =
SODIUM, DISSOLVED	MG/L				146 =	234 =	250 =	226 =	247 =
VANADIUM, DISSOLVED	MG/L	0.04		0.03	0.017 J	0.0238 J	0.029 J	0.0192 J	0.0176 J
ZINC, DISSOLVED	MG/L	0.14	5.00	1.10	0.0073 J	0.0025 U	0.0025 U	0.0025 U	0.118 =
Total Metals									
ALUMINUM	MG/L		0.05	3.65	0.886 = M -	0.291 = M -	1.49 = M -	0.221 = M -	18.8 = M T
ANTIMONY	MG/L		0.01	0.001	0.0014 U	0.0014 U	0.0014 U	0.0016 J - T	0.0014 U
BARIUM	MG/L	0.28	2.00	0.26	0.0612 J	0.072 J	0.0636 J	0.0709 J	0.141 J
CALCIUM	MG/L				43.2 =	38.9 =	37.5 =	48 =	46.5 =
CHROMIUM, TOTAL	MG/L	0.02	0.10	0.11	0.008 J	0.0022 J	0.0073 J	0.0018 J	0.0284 =
COBALT	MG/L	0.02		0.22	0.00093 J	0.0005 U	0.0016 J	0.0005 U	0.0152 J
COPPER	MG/L	0.04	1.00	0.15	0.0044 J	0.0029 J	0.0057 J	0.0038 J	0.0458 =
IRON	MG/L		0.30	1.10	1.38 = M T	0.284 =	1.66 = M T	0.257 =	23.9 = M T
LEAD	MG/L		0.01		0.0011 U	0.0012 J	0.0011 U	0.0011 U	0.0034 =
MAGNESIUM	MG/L				27.7 =	25.8 =	25.4 =	34.1 =	38.6 =
MANGANESE	MG/L		0.05	0.07	0.196 = M T	0.0288 =	0.149 = M T	0.173 = M T	0.819 = M T
NICKEL	MG/L	0.02	0.10	0.07	0.0039 J	0.002 J	0.0029 J	0.0022 J	0.0148 J
POTASSIUM	MG/L				3.32 J	3.46 J	3.39 J	3.9 J	5.65 J
SELENIUM	MG/L	0.02	0.05	0.02	0.0021 U	0.0058 =	0.0026 J	0.0027 J	0.0072 =
SODIUM	MG/L				140 =	232 =	251 =	232 =	250 =
VANADIUM	MG/L	0.04		0.03	0.0194 J	0.0244 J	0.035 J - T	0.0224 J	0.0839 = - T
ZINC	MG/L	0.14	5.00	1.10	0.0102 J	0.0025 U	0.0025 U	0.0028 J	0.0503 =
Semi-Volatiles									
DIETHYL PHTHALATE	MG/L			29.00	0.005 U	0.01 =	0.005 U	0.008 =	0.005 U

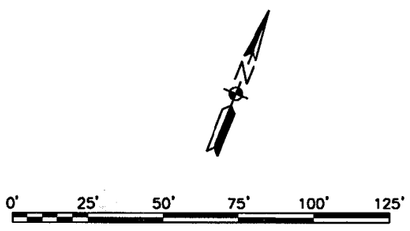
Table 12-2
Surface Soil Analytical Data Summary
C-C, NASD - Vieques, PR

StationID			AF-SB01	AF-SB01	AF-SB01	AF-SB01	AF-SB01	AF-SB02	AF-SB02	AF-SB02	AF-SB02	AF-SB02	AF-SB03	AF-SB03	AF-SB03	AF-SB04	AF-SB04	AF-SB04	AF-SB04
SampleID			NDA235	NDA236	NDA238	NDA239	NDA240	NDA241	NDA242	NDA243	NDA244	NDA245	NDA246	NDA248	NDA249	NDA252	NDA253	NDA254	NDA255
Collection Depth			4 To 6	9 To 11	14 To 16	19 To 21	24 To 26	4 To 6	9 To 11	14 To 16	19 To 21	24 To 26	4 To 6	9 To 11	14 To 16	4 To 6	9 To 11	14 To 16	19 To 21
Date Collected		Screening Criteria	04/11/2000 10:25	04/11/2000 10:45	04/11/2000 11:20	04/11/2000 11:49	04/11/2000 13:37	04/11/2000 14:25	04/11/2000 14:43	04/11/2000 14:53	04/11/2000 15:25	04/12/2000 9:00	04/12/2000 11:30	04/12/2000 13:05	04/12/2000 13:30	04/12/2000 14:12	04/12/2000 14:34	04/12/2000 15:00	04/12/2000 15:20
Parameter Name	Units	BKG / SSL (L)																	
Metals																			
ALUMINUM	MG/KG		9280 =	8080 =	15200 =	23000 =	20100 =	6900 =	8030 =	17600 =	17000 =	23500 J	9570 J	8940 J	25900 J	6790 J	10600 J	10700 J	24600 J
ANTIMONY	MG/KG	1.76 / 13.20	0.18 UJ	0.16 UJ	0.16 UJ	0.16 UJ	0.4 J	0.16 J	0.18 UJ	0.21 J	0.15 UJ	0.73 J	0.17 UJ	0.17 UJ	0.87 J	0.16 UJ	0.18 UJ	0.18 UJ	0.17 UJ
ARSENIC	MG/KG	2.08 / 0.03	0.45 U	0.46 J -	0.51 J -	0.51 J -	0.41 U	0.38 U	0.82 J -	0.55 J -	0.38 U	0.4 U	0.42 U	0.49 J -	0.38 U	0.4 U	0.55 J -	0.43 U	0.57 J -
BARIUM	MG/KG	167.17 / 2105.32	71.2 =	230 =	478 =	199 =	145 =	72.2 =	222 =	168 =	75 =	106 =	94.1 =	137 =	692 =	63.5 =	156 =	88.3 =	102 =
BERYLLIUM	MG/KG	0.58 / 1153.69	0.28 J	0.45 J	0.37 J	0.28 J	0.11 J	0.18 J	0.57 J	0.28 J	0.18 J	0.18 J	0.19 J	0.42 J	0.2 J	0.12 J	0.47 J	0.27 J	0.21 J
CALCIUM	MG/KG		2290 =	2850 =	5010 =	5600 =	5670 =	3030 =	2650 =	4890 =	5120 =	5710 J	3280 J	1790 J	11200 J	2120 J	2320 J	7940 J	6160 J
CHROMIUM, TOTAL	MG/KG	45.92 / 40.00	8.8 =	14.7 =	59.3 = -	118 = -	129 = -	8.2 =	11.2 =	27.7 =	19.2 =	28.4 J	9.9 J	7.3 J	24.7 J	7.7 J	12.7 J	23.2 J	75.4 J -
COBALT	MG/KG	39.41	9.1 J	17.6 =	63.2 =	42.1 =	31.3 =	7.4 J	16.7 =	21.5 =	18.7 =	23.4 J	10.1 J	8.4 J	27.3 J	6.6 J	13.5 J	11 J	38.3 J
COPPER	MG/KG	147.78 / 10517.84	32.3 J	28.2 J	60.4 J	120 J	91 J	25.9 J	28.9 J	66.9 J	52.6 J	55.2 J	27.8 J	27.6 J	54.9 J	19.9 J	29.3 J	29.7 J	60.4 J
IRON	MG/KG	9360.00	19700 =	19500 =	33100 =	45300 =	34000 =	16200 =	19300 =	43300 =	33700 =	42700 =	18700 =	17300 =	48300 =	12500 =	23700 =	23000 =	37200 =
LEAD	MG/KG	4.19	1.5 =	2.6 =	2.3 =	0.67 J	0.13 U	1.8 =	1.6 =	0.8 =	0.12 U	0.54 J	2.1 =	1.4 =	0.12 U	2.3 =	1.8 =	1.5 =	1.1 =
MAGNESIUM	MG/KG		3690 =	2830 =	13100 =	22700 =	17400 =	2650 =	2760 =	12100 =	14100 =	17300 J	2960 J	3030 J	20400 J	1740 J	3360 J	3930 J	17700 J
MANGANESE	MG/KG	2516.77 / 950.00	372 =	1550 = -	3090 = -	1300 = -	1090 = -	424 =	1390 = -	965 = -	516 =	809 =	510 =	923 =	921 J	483 =	1230 = -	544 =	723 =
MERCURY	MG/KG	0.04 / 2.10	0.012 U	0.011 U	0.01 U	0.011 U	0.012 U	0.014 U	0.014 U	0.012 U	0.012 U	0.015 U	0.015 J	0.015 U	0.014 U	0.014 U	0.014 U	0.017 U	0.016 U
NICKEL	MG/KG	32.18 / 100.00	4.4 J	9.7 =	37 =	37.1 =	43.7 =	4.1 J	9.7 J	15.2 =	13.2 =	17.8 J	4.9 J	6.7 J	26.3 J	3.7 J	7.1 J	7 J	43.2 J
POTASSIUM	MG/KG		1320 =	853 J	598 J	180 J	213 J	902 J	985 J	811 J	345 J	755 J	1290 J	1160 J	512 J	890 J	1710 J	1380 J	543 J
SELENIUM	MG/KG	1.85 / 18.98	0.28 U	0.54 J	0.24 U	0.24 U	0.25 U	0.24 U	0.28 J	0.25 U	0.23 U	0.24 U	0.46 J	0.42 J	0.23 U	0.41 J	0.27 U	0.27 U	0.26 U
SILVER	MG/KG	/ 31.03	0.066 U	0.057 U	0.057 U	0.057 U	0.097 J	0.056 U	0.063 U	0.059 U	0.055 U	0.31 J	0.062 U	0.061 U	0.056 U	0.059 U	0.063 U	0.063 U	0.062 U
SODIUM	MG/KG		128 J	303 J	349 J	2120 =	1800 =	82.6 J	113 J	1130 J	932 J	1140 J	63 J	105 J	12.9 U	63.9 J	132 J	164 J	2470 =
THALLIUM	MG/KG	/ 3.64	0.92 J	1.2 J	1.4 J	1.4 J	0.94 J	0.77 J	1.2 J	1.7 J	1.4 J	0.31 U	0.99 J	0.85 J	0.3 U	0.32 U	0.83 J	0.76 J	1 J
VANADIUM	MG/KG	169.89 / 5111.02	57.1 =	75.2 =	135 =	163 =	81.8 =	48.5 =	67.7 =	148 =	97.8 =	129 J	54.2 J	55.2 J	160 J	36.6 J	84 J	80.9 J	129 J
ZINC	MG/KG	132.11 / 13621.80	31.9 J	24.4 J	40.6 J	56.2 J	48.6 J	27.7 J	25.8 J	55.7 J	47.1 J	63.7 J	29.6 J	29.5 J	71.6 J	28.2 J	28.9 J	30.2 J	60.4 J
Pesticides																			
p,p'-DDE	MG/KG	/ 35.22	0.0044 UJ	0.0038 UJ	0.0037 UJ	0.0037 UJ	0.004 UJ	0.0037 UJ	0.0042 UJ	0.0039 UJ	0.0037 UJ	0.0038 UJ	0.00047 J	0.004 UJ	0.0037 UJ	0.0039 UJ	0.0042 UJ	0.0042 UJ	0.0041 UJ
Volatiles																			
CARBON DISULFIDE	MG/KG	/ 19.00	0.012 U	0.01 U	0.01 U	0.011 U	0.012 U	0.01 U	0.01 U	0.01 U	0.011 U	0.01 U	0.0004 J	0.011 U	0.0003 J	0.012 U	0.011 U	0.011 U	0.01 U
METHYL ETHYL KETONE (2-BUTANONE)	MG/KG	/ 7.90	0.012 R	0.01 R	0.01 R	0.011 R	0.012 R	0.01 R	0.01 R	0.01 R	0.011 R	0.004 J	0.007 J	0.011 R	0.002 J	0.002 J	0.011 R	0.011 R	0.01 R
BENZENE	MG/KG	/ 0.002	0.012 U	0.01 U	0.01 U	0.011 U	0.012 U	0.01 U	0.01 U	0.01 U	0.011 U	0.0002 J	0.0001 U	0.011 U	0.01 U	0.012 U	0.011 U	0.011 U	0.01 U
1,2-DICHLOROETHANE	MG/KG	/ 0.001	0.012 U	0.01 U	0.01 U	0.011 U	0.012 U	0.01 U	0.01 U	0.01 U	0.011 U	0.0003 J	0.01 U	0.011 U	0.0003 J	0.012 U	0.011 U	0.011 U	0.01 U
TOLUENE	MG/KG	/ 8.79	0.012 U	0.01 U	0.01 U	0.011 U	0.012 U	0.01 U	0.01 U	0.01 U	0.011 U	0.01 U	0.01 U	0.011 U	0.0004 J	0.012 U	0.011 U	0.011 U	0.01 U
CHLOROBENZENE	MG/KG	/ 0.80	0.012 U	0.01 U	0.01 U	0.011 U	0.012 U	0.01 U	0.01 U	0.01 U	0.011 U	0.01 U	0.0007 J	0.011 U	0.01 U	0.012 U	0.011 U	0.011 U	0.01 U
M,P-XYLENE (SUM OF ISOMERS)	MG/KG	/ 170.00	0.012 U	0.01 U	0.01 U	0.011 U	0.012 U	0.01 U	0.01 U	0.01 U	0.011 U	0.0002 U	0.01 U	0.0003 J	0.0009 J	0.012 U	0.0004 J	0.0007 J	0.01 U
O-XYLENE (1,2-DIMETHYLBENZENE)	MG/KG	/ 229.95	0.012 U	0.01 U	0.01 U	0.011 U	0.012 U	0.01 U	0.01 U	0.01 U	0.011 U	0.01 U	0.01 U	0.011 U	0.0004 J	0.012 U	0.011 U	0.011 U	0.01 U
XYLENES, TOTAL	MG/KG	/ 170.19	0.012 U	0.01 U	0.01 U	0.011 U	0.012 U	0.01 U	0.01 U	0.01 U	0.011 U	0.0002 U	0.01 U	0.0003 J	0.0013 J	0.012 U	0.0004 J	0.0007 J	0.01 U

The risk-based concentrations are based on a hazard quotient (HQ) of 0.1 and an excess lifetime cancer risk of 10-6.
BKG = background (2 times average) values from AFWTF Camp Garcia Western Perimeter Study (November 1999)
SSL = EPA Region III Soil Screening Level for Groundwater Migration (with a dilution factor (DAF) of 20







LEGEND

FENCE	———
POWER POLE	⌀
SEPTIC TANK	▨
MONITORING WELL	●
SANITARY SEWER MANHOLE	○ MH
SOIL BORING	■ SB-01

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Figure 12-1 AOC-F
Sample Locations
Naval Ammunition Support Detachment, Vieques Island

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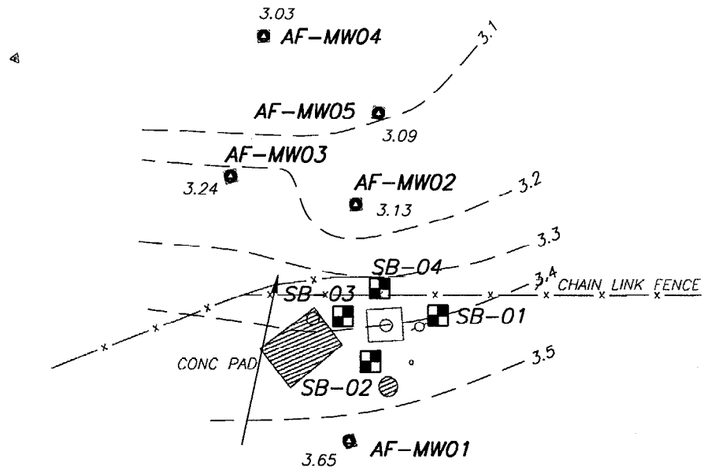

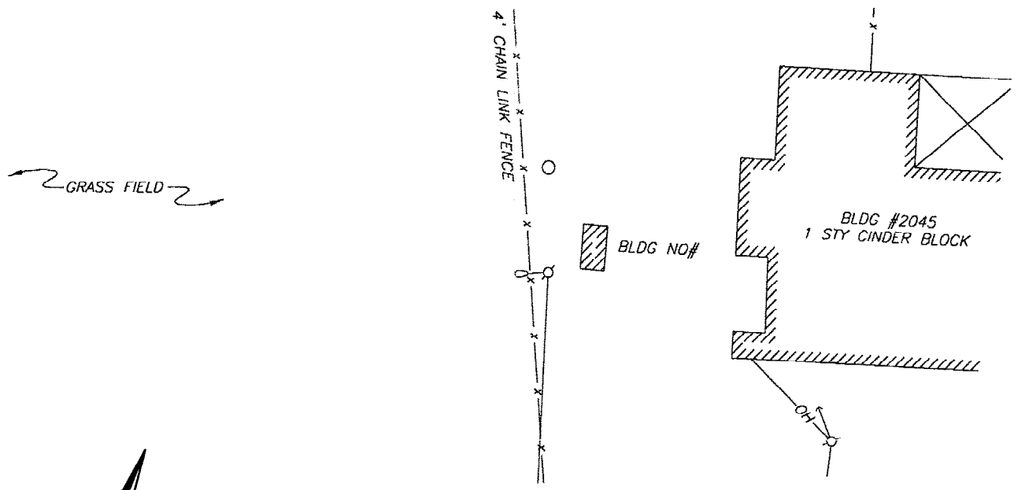

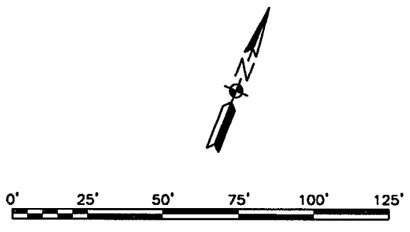

LEGEND

FENCE	— x — x —
POWER POLE	ø
SEPTIC TANK	
MONITORING WELL	
SANITARY SEWER MANHOLE	MH
SOIL BORING	SB-01
GROUNDWATER ELEVATION (FEET MSL) MSL = MEAN SEA LEVEL	-1.54
GROUNDWATER CONTOUR CONTOUR INTERVAL 0.5 FEET	— — -1.5 — —
GROUNDWATER FLOW DIRECTION	

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Figure 12-2 AOC-F
Groundwater Flow
Naval Ammunition Support Detachment, Vieques Island

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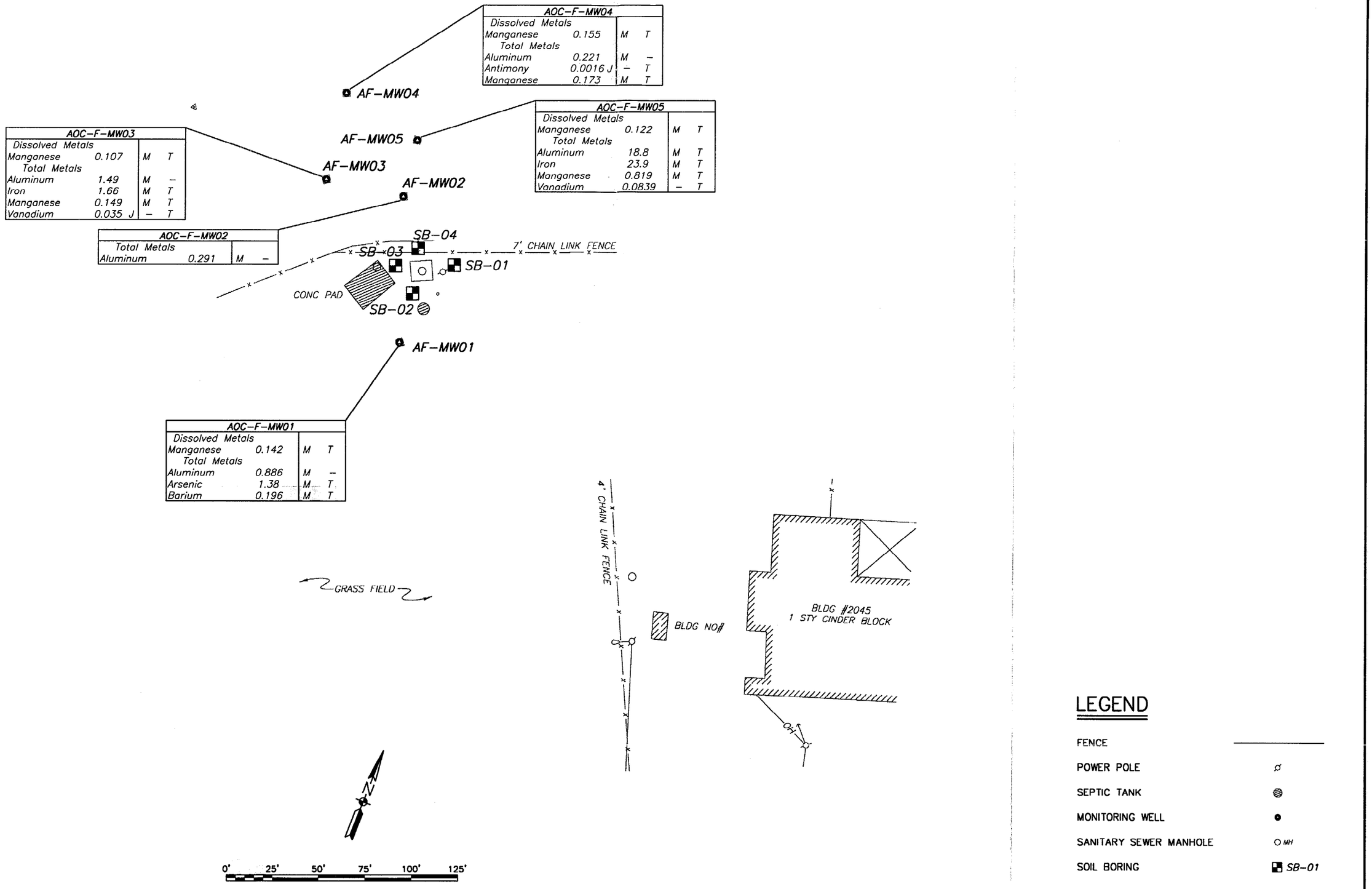

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Figure 12-3 AOC-F
Groundwater Detections Above Screening Criteria
Naval Ammunition Support Detachment, Vieques Island

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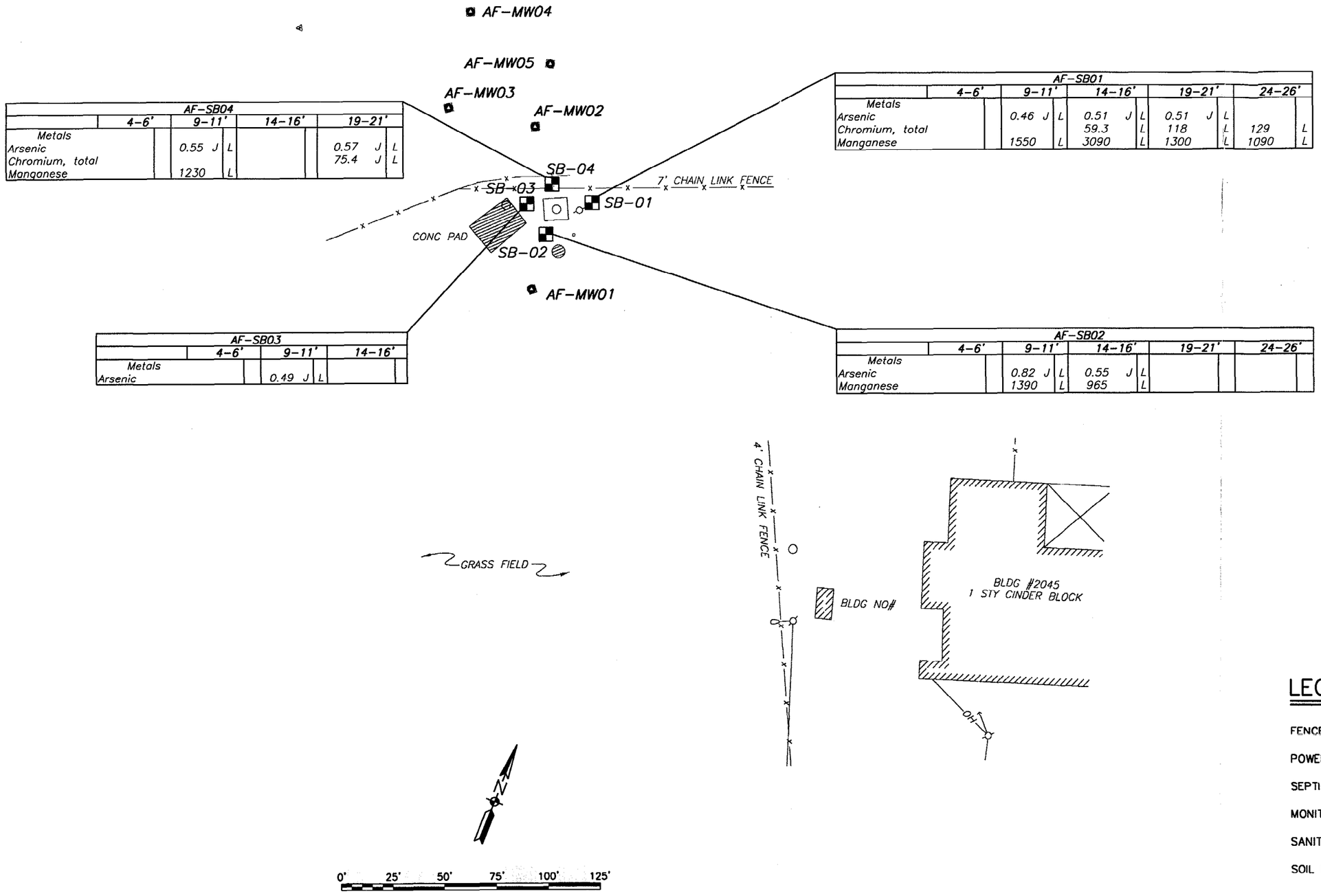

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Figure 12-4 AOC-F
Soil Detections Above Screening Criteria
Naval Ammunition Support Detachment, Vieques Island

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SECTION 13

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